MARCH 1960

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Electrical South

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See page 30

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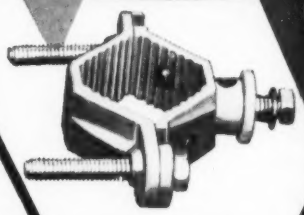

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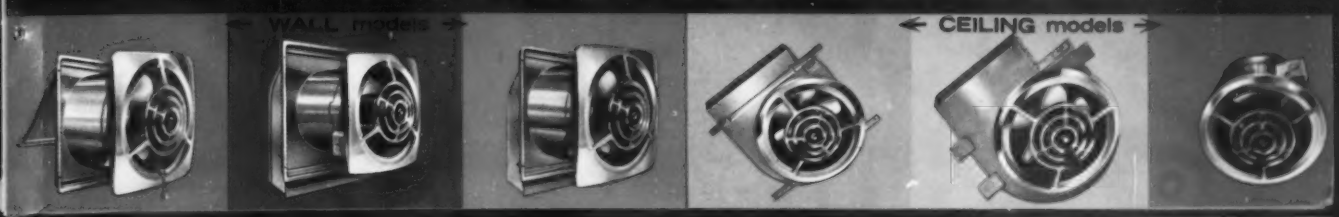

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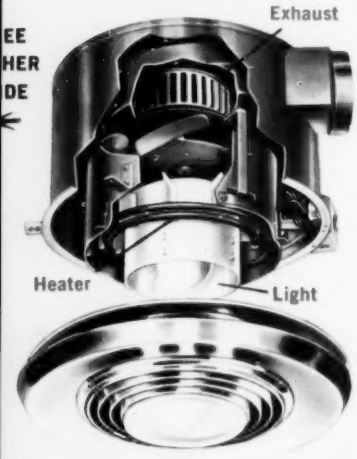

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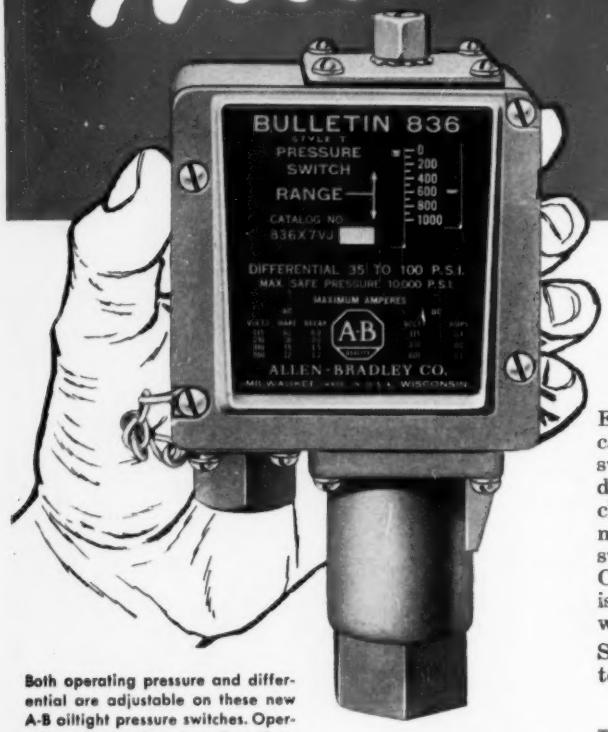

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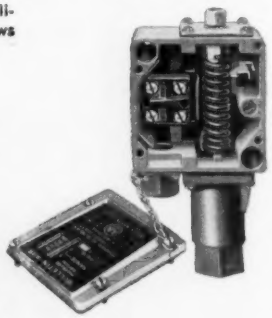

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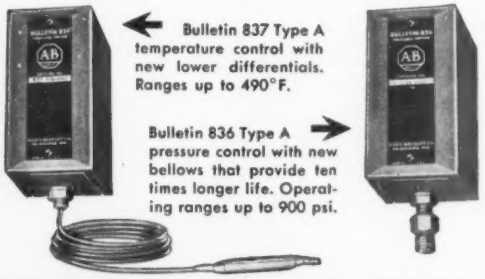

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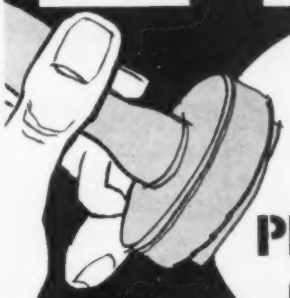

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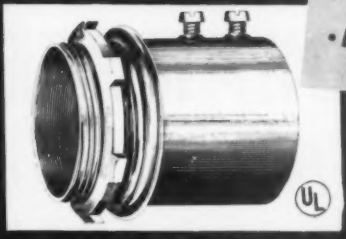

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Economic comment

by J. Whitney Bunting, Ph.D.

Contributing Economics Editor

The inventory problem

Ask the average merchant or businessman about the importance of maintaining inventories for either production or distribution and he will inform you that this is one of the more serious problems he has to face in the conduct of his business. At the present moment, on a national scale, this is a most serious problem for everyone of us. It could well mean an over-inflated picture of economic prosperity that could live to haunt many of the nation's leading industries. And like so many of today's economic problems, it can be traced right back to the recently settled steel controversy.

As has often been stated in this column, the American economy is so dependent upon steel that any changes in the economics of this material seriously affects progress in hundreds of other industries.

When steel was in short supply during the height of the strike, a huge backlog of orders was built up by the industry. Some of this demand was based upon immediate production needs, such as by the automobile industry that needed steel for new models. In other instances, there was an apparent desire to obtain a sufficient supply of steel and other materials to serve as an inventory in the event of emergency or other factors that might limit supply.

As a result, when the steel industry did return to full production, it was faced with an inflated demand for its products and has been geared in this direction ever since.

It is unfortunate that this situation has existed in such an important industry as steel for it has shaped the thinking of many businessmen and industrialists throughout the economy. Having seen the effect of the steel shortage, in terms of layoffs, ruined production schedules, profit losses, and other problems, they are now decidedly more inventory-conscious than before.

As a result, we are seeing a great deal of over-buying by industry to insure continued production in the event of emergency. Thus the production figures of some of our more basic industries (metals, automobiles, heavy machinery and appliances) are not realistic when measured in terms of current demand.

It is difficult to analyze how much production is for normal demand and how much is intended to build up stocks of finished or partly-finished materials. Yet, for those who wish to estimate the strength of the present rate of production, it is necessary to factor in the inventory problem.

Affect on prices?

One of the more serious results that occurs to the economic system when production is carried on to satisfy normal demand plus to build inventories is the artificial effect upon prices. Normally this creates an artificially high demand against a temporarily short supply. The competitive bidding of buyers, regardless of what their purpose may be, tends to force prices up unless there is some pressure to the contrary.

In the past, this has nearly always been the case and there are many examples on record where the price levels of basic industrial materials were raised by inflated demand only to drop to disastrously low levels when the anticipated emergency ended or failed to develop.

It is a reflection of the strength of America's present industrial leadership that current conditions have not tended to force prices up to unusual heights. There appears to be a definite trend in industrial opinion to present a solid front against price increases that could lead to depressed economic conditions. A survey of many of the products used indicates that in many cases the price tags are lower than they were only a few short years ago.

This is not true of services where the human element is the principle factor involved. Medical costs, professional services, and other items of a similar nature, show an increase in price level. But appliances, automotive parts and accessories, some home furnishings, and many other manufactured goods for the consumer, are ranging from one to five per cent lower in price than a few short years ago.

In addition, as of this moment, there has been no surge toward increased credit either by businessmen or by consumers. In the latter case, the amount of new credit demanded has been exceeding repayments of old credit by only a negligible amount. Certainly, it is far less than would be expected in a period of prosperity.

Many observers believe that this lull in borrowing is temporary in nature and that the spring upsurge anticipated in automobile sales will push consumer credit to unprecedented levels. This is the feeling that permeates the atmosphere in Detroit as the major automotive companies are building dealer inventories as fast as steel shipments and production schedules allow.

Business statesmanship

One fact is becoming more and more apparent in today's economic scene, and that is the role of the American businessman in the conduct of political and economic affairs. This leadership by professional business managers is being found at all levels of government and community life and is one of the more healthy aspects of the current economic scene.

Recognition of the fact that sound business conditions leads to community and national prosperity and well being has dictated that those actively associated with business assume responsibility for political affairs. With this as a basis for active interest, many businessmen are now reaching toward their full potential as leaders in the modern world.

Regardless of the size of the business represented or of the community in which active interest is needed, every businessman should work toward the development of a better business climate to the greatest extent possible.

Dr. Bunting is a well-known economist and educator having special knowledge of the South.

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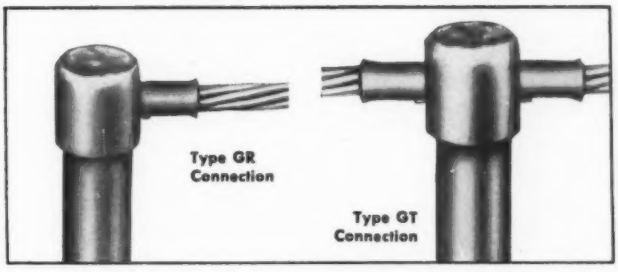

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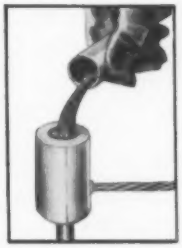

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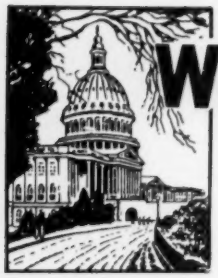


Washington report

By Jack James

Digest of Washington news of special interest to the electrical industry

January construction down less than usual

EXPENDITURES for new construction dropped eight per cent in January, but the decline was less than usual for the month. Total outlays on a seasonally adjusted basis were at an annual rate of $54.6 billion in January compared with $51.9 billion in December and $50.6 billion in November.

The Census Bureau of the Department of Commerce reported these figures. Economists at the Bureau predict that construction spending throughout 1960 will rise about 2 per cent, mostly because of price increases.

TVA electricians get 4 per cent pay raises

THE TENNESSEE Valley Authority, required by law to pay prevailing wage rates, granted a pay increase of 4 per cent to 8,500 construction and maintenance employees. Old rate for electricians was $3.45 an hour. New rate is $3.57½ an hour.

Has government aid really helped housing

THIRTY-FIVE years ago without government intervention, contractors erected houses at a higher rate than in the mid-1950's, a spokesman for the Chamber of Commerce of the United States pointed out recently to a Congressional committee.

"Offhand," Dr. Emerson P. Schmidt, Director of Economic Research for the Chamber said, "this unfavorable showing for the government interventionist period causes one to wonder whether all this congressional concern for housing was justified in the past 20 or 25 years, and whether its continuation in the future is wise."

Both mid-1920's and mid-1950's were prosperous years, Dr. Schmidt noted. Yet analysis of non-farm housing starts for the years 1955 and 1956 shows 3.38 and 2.78 starts respectively per million dollars of Gross National Product as compared with 5.79 and 4.79 starts for the years 1925 and 1926. (For the purpose of this comparison, the Gross National Product for all of the years involved was reduced to an equivalent based on 1954 prices. A similar comparison made on a basis of the number of starts per thousand population showed 8.09 and 7.23 respectively for 1925 and 1926 as compared 8.04 and 6.65 starts respectively for the years 1955 and 1956.

The Chamber's spokesman appeared before the Joint Economic Committee to discuss the *Economic Report of the President* to Congress. He did not specifically mention the Federal Housing and Veterans Administrations.

He also pointed out that the *Economic Report* was "unwittingly feeding the fires of inflation" by approving union wage raises tied to the national average productivity. The national average could easily become a floor for raises, he said. If some unions got more, as would be certain, inflation would get a push.

How the Government competes for savings

CHANCES are that besides being a business man you are a saver. You have been putting money in banks or savings and loan associations. Perhaps now as thousands of other investors, you have shrewdly switched your money into government bonds—bonds that give you an annual interest of 5 per cent. You probably get about two per cent more on your savings. And after the interest rates of banks, etc., drop off from their present peak, you will continue to get a high five per cent return.

But what has happened because of the smart investment shifts you and thousands others are making? The banks and associations that would have had money to put into mortgages or company bonds don't have these savings to help homebuilders and companies get cash to expand. Instead the savings are being used by the Government to build missiles, make the payments on wheat storage ($1,000 a minute according to President Eisenhower) and support other Government programs.

The banks and associations are even afraid of making mortgages backed by the deposits they have. You might pull your deposit out to invest in a Government bond.

This is one way that Government high interest rates are holding down construction. And in effect holding down inflation by keeping demand from outrunning supply. Since the 1958 recession, construction has been intense. In 1959 construction starts set a new record. Moneywise, the prediction is that another record will be set in 1960.

The high interest rates might actually be keeping a boom from ballooning and bursting.

Employer forms for labor act reports

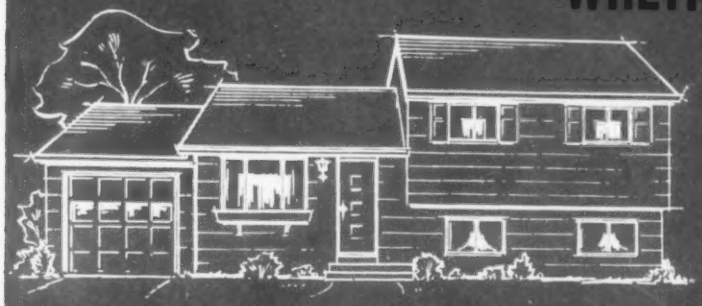
THE DEPARTMENT of Labor issued a tentative form to help employers file reports as required by the Kennedy-Landrum Act. Since the Department gave employers but 15 days to make objections, the final form probably won't be changed much. Here are the questions that you will probably be asked. If you can answer, "Yes," to a question, you must file. Otherwise, not.

"During the fiscal year did you make or promise to make, directly or indirectly any payment or loan of money or other thing of value (including reimbursed expenses) to any labor organization or to any officer, agent, shop steward, or other representatives or employees of any labor organization?" [Sporadic and occasional small gifts and favors don't count.]

"During the past fiscal year did you make, directly or indirectly, any payment (including reimbursed expenses) to any of your employees, or to any group or committee of your employees, for the purpose of causing them to persuade other employees to exercise or not to exercise, or as to the manner of exercising, the right to organize and bargain collective-

(Continued on page 124)

WHETHER IT COSTS...



$15,000

OR

$50,000

REMCON LOW-VOLTAGE SWITCHING—FOR ANY HOME!

Sidney Gotowner, Gotowner Electric, Rego Park, L. I. "Even the man who spends $15,000 for a home has a right to luxury, and Remcon helps me provide it at a profit! I can build in three- and four-way switching quickly—at *lower labor costs*—because Remcon's #18 wire ends the need to run heavy armored cable. And the transformer's in the relay. I'm sold, and my tracts go just as fast."

Ephraim Berkowitz, Turnpike Electric, Franklin Sq., L. I. It's the little touches that make Remcon so appealing to my clients...remote control of any light in the house from as many high-fashion switches as they wish...master control convenience from the bedroom to save steps...path-of-light safety to eliminate fumbling in the dark. And the beauty of it is Remcon is a 'plus' that's practical in *any* home."

Find out how versatile and flexible Remcon can be in your houses. Send in your plans for a free wiring diagram and estimate.

REMCON

a Division of Pyramid Instrument Corp.,
630 Merrick Road, Lynbrook, N. Y. RTC-5A

GROW FAST

WITH Cavalier ELECTRIC HEAT

Ride the tide of popular demand for Cavalier automatic electric heat.

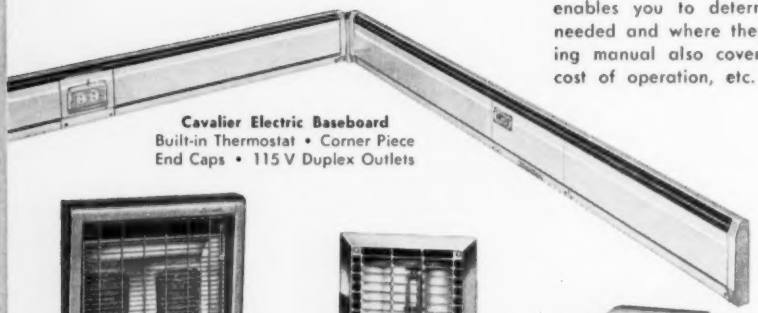
Most often, Cavalier electric heat is the ideal installation for new homes or old, offering more flexibility in planning, more comfort for the user. Cavalier heat is the simplest ever devised, is easily installed and guarantees years of trouble-free service. You'll find it easy to promote.

A wealth of engineering and merchandising service is available at Cavalier. If you would like help in getting your share of this important and fast growing market, just let us know.

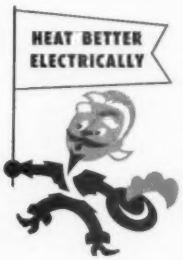
Merchandising help — National advertising is backed by folders, inserts, ad-mats, posters, displays, trade shows, radio and TV spots and the whole range of promotional activities to help you **GROW** with **CAVALIER.**

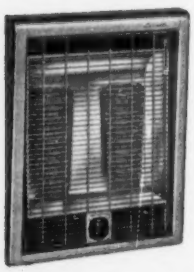
Cavalier . . . THE COMPLETE LINE

GUIDE FOR CALCULATIONS OF ELECTRIC SPACE HEATING enables you to determine what Cavalier units are needed and where they should be placed. This working manual also covers loss, insulation requirements, cost of operation, etc.

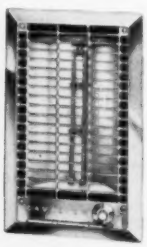


Cavalier Electric Baseboard
Built-in Thermostat • Corner Piece
End Caps • 115 V Duplex Outlets

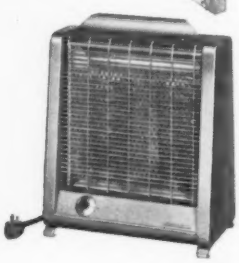




Cavalier Wall Insert
1 to 5 KW



Cavalier Bathroom
Automatic and non-automatic
120 and 240 volt



Cavalier Portable
2, 3, 4 KW

Cavalier
Radiant Cable

HIGHEST QUALITY Electric Heating Equipment sold only through trade channels to safeguard the consumer, the contractor and the distributor.

ELECTRIC HEATING DIVISION **CAVALIER CORPORATION** CHATTANOOGA 2, TENNESSEE

OUR 95th YEAR OF QUALITY PRODUCTS

FIRST *in quality construction*
in engineering advances
in safety
in sales making features

All your answers are in the bag with PYRAMID

Amprobe Test-Master Kit keeps all equipment right at hand...handsomely.

Truly the sign of the professional, this rugged, good-looking, genuine cowhide case contains all the equipment *you* need to do all your electrical testing jobs with precision and accuracy.

Compact, neat and sturdy, the Test-Master Kit is specially designed to hold any one of the famous Amprobe RS models, the Amprobe Deca-Tran, the Amprobe Energizer and the Test-Master has a separate covered section to hold your small hand tools easily, within reach.

The Test-Master comes in two models: **TM33** contains the world-famous Amprobe RS-3 snap-around volt-ammeter-ohmmeter: 5 current ranges, 3 voltage ranges. Amprobe Deca-Tran: Extends amperage reading 10x, as high as 1200 amps. Amprobe Energizer: Multiplies sensitivity of any Amprobe 10x for readings on small appliance and fractional h.p. motors. **$84.50**

TM11 contains the Amprobe RS-1, economy snap-around volt-ammeter. Amprobe Deca-Tran and Amprobe Energizer. **$71.75**

The Amprobe Test-Master Kit, RS-3, Deca-Tran and Energizer are all products of

PYRAMID INSTRUMENT CORPORATION, LYNBROOK, N.Y. WORLD'S LARGEST MANUFACTURER OF SNAP-AROUND TEST INSTRUMENTS

CATALOGS and BULLETINS

Available Free to Readers of Electrical South upon Request

LIGHTING PANELBOARDS — A 4-page descriptive folder featuring a line of plug fuse and toggle switch panelboards for lighting control circuits is now available from Frank Adam Electric Co., 3650 Windsor Pl., St. Louis, Mo. The folder includes box sizes, details of construction, wiring gutters, special features, and catalog numbers.

Write in No. D100 on card, Pg. 20

CIRCUIT PROTECTION — A 24-page illustrated handbook contains suggestions for selecting the right kind of protection for electric circuits, motors, appliances and apparatus. Includes motor wiring diagrams and a complete list showing proper size fuses to use. Available from Bussman Mfg. Co., University at Jefferson, St. Louis 7, Mo.

Write in No. D102 on card, Pg. 20

MODULAR LIGHTING—A twelve-page folder describing and illustrating their line of surfaced and recessed fluorescent modular fixtures is announced by Moe Light of Thomas Industries Inc., Lighting Division, 410 S. Third St., Louisville, Ky. Complete coefficient of utilization and candlepower distribution tables are included for each set of fixtures.

Write in No. D104 on card, Pg. 20

MANHOLE HEATER—A four-page brochure issued by Morrison-Pelsue Co., 2256 S. Delaware S., Denver 23, Col., describes and illustrates applications of the MoPeCo Ventilating Heater available in several models, electrical or gasoline engine powered.

Write in No. D105 on card, Pg. 20

HYDRAULIC POWER TOOLS—A new bulletin describing their two-speed, fast-approach portable power unit for hydraulic tools such as conduit benders, cable pullers, and pipe pushers is announced by Greenlee Tool Co., Rockford, Ill.

Write in No. D108 on card, Pg. 20

CONDUIT WIREHOLDERS — A new information sheet describing their line of all-purpose conduit wireholders is now available from Knox Porcelain Corp., P. O. Box 2031, Knoxville, Tenn. The illustrated sheet gives installation information, design features, and specifications.

Write in No. D109 on card, Pg. 20

LAMP GUIDES—Sylvania Lighting Products, 60 Boston St., Salem, Mass., has made available three lamp guides containing general information, technical data, and catalog listings on their lines of fluorescent lamps, incandescent lamps, and mercury lamps.

Write in No. D110 on card, Pg. 20

PLUGS, RECEPTACLES — Two basic designs — explosion-proof and weatherproof—of Killark plugs and receptacles are fully covered in a new catalog section. This line offers many advantageous features, and is available in many styles and sizes to fit various boxes. Killark Electric Mfg. Co., Easton and Vandeventer Ave., St. Louis 13, Mo.

Write in No. D111 on card, Pg. 20

ELECTRICAL DEVICES — Two publications, the pocket Federalog 111-PR and Bulletin 3-230, have been made available by Federal Pacific Electric Co., 50 Paris St., Newark, N. J. Complete details concerning circuit breakers, panelboards, fusible service equipment, safety switches, industiral motor control and lighting and power panelboards are contained in the 32-page pocket-sized catalog. The 8-page bulletin is devoted to the company's new line of QMQB fusible switches and panelboards.

Write in No. D112 on card, Pg. 20

BUILT-IN HEATERS—Thermador Electrical Manufacturing Co., 5119 District Blvd., Los Angeles 22, Calif., has announced the availability of three new catalog sheets on their line of built-in electric heaters. The heaters described are their portable radiant-fan heater, electric ceiling heater, and baseboard electric heater.

Write in No. D113 on card, Pg. 20

PRICE SERVICE—Specimen copies of the National Price Service price books are available on request from Henderson-Hazel Corp., 13601 Euclid Ave., Cleveland 12, Ohio. Please indicate whether you are a contractor or wholesaler. Each specimen includes a complete index, a representative sampling of completely illustrated price sheets, and information of special interest to those concerned with pricing electrical construction materials.

Write in No. D114 on card, Pg. 20

FLUORESCENT FIXTURES—The new Miller Sabre fluorescent fixture is illustrated in the Sabre catalog, page 13, published by The Miller Company, Meriden, Conn. This page points out application, construction details, and dimensional, illumination, and installation data.

Write in No. D115 on card, Pg. 20

CABLE SUPPORTING TRAYS—The Globe Co., 4000 South Princeton Ave., Chicago 9, Ill., has made available a new catalog on their line of cable supporting tray systems and accessories. The catalog contains information on design features, specifications, and installation.

Write in No. D116 on card, Pg. 20

CENTRIFUGAL ROOF VENTILATORS—An 8-page, two-color folder (SDA-220) gives construction features, performance data, dimensions and recommended specifications for the new Centrifugal Roof Ventilator manufactured by The Peerless Electric Company, Warren, Ohio. Other important Peerless Fan and Blower products and a list of Peerless sales representatives are also included.

Write in No. D117 on card, Pg. 20

ELECTRICAL FITTINGS—A 30-page illustrated catalog and price list of electrical fittings is now available from the Bridgeport Fittings, Inc., 209 Center St., Bridgeport, Conn. The catalog is loose-leaf type and contains complete ordering data for the wide range of fittings and devices in this line.

Write in No. D119 on card, Pg. 20

SPACE HEATING GUIDE—Cavalier Corp., Chattanooga 2, Tenn., has prepared a Guide for Calculations on Electric Space Heating. It is based on a study of several thousand installations of electric heat and is a handy reference for calculating electric heating requirements and estimating operating costs. The booklet contains discussion, charts and floor plan examples.

Write in No. D120 on card, Pg. 20

NON-METALLIC FIXTURES — A new complete condensed catalog with list prices covering their complete line of non-metallic lighting fixtures is now available from Union Insulating Co., P. O. Box 351, Parkersburg, W. Va.

Write in No. D122 on card, Pg. 20

CONNECTOR BULLETINS — Six new bulletins have been released by Ilsco Corp., 4730 Madison Rd., Cincinnati, Ohio. They cover the Ilsco line of solderless connectors, special

On a job like the Illuminating Building...

Harrington Electric figures costs closely

...but doesn't take chances!

You'd expect to see quality products on jobs like The Illuminating Building—including, of course, Burndy connectors. Harrington Electric Company, contractors on this **$2,000,000**-plus electrical job, used Burndy connectors throughout the 5500 KVA electrical system...and at a cost less than 1/6 of 1% of the total. Harrington figures costs closely...but knows that it doesn't pay to take chances with the connections that safeguard the dependability of eleven high-speed elevators, 2200 tons of air conditioning and a lighting system that provides from 50 to 400 foot candles of office illumination in the 400,000 square foot building.

"When handling a large job, such as The Illuminating Building, a contractor doesn't have time to check into the many limitations of Burndy on the market, to see if the savings they offer are worth the chance of making a poor connection. Therefore, I use Burndy because I know from past experience that I can depend on the quality to be consistently good, at a fair price."

—Al Fuerst, Vice President; Harrington Electric Co., Cleveland, Ohio

The Illuminating Building, Cleveland, Ohio
Owner—55 Public Square, Inc., Robert Arnow, President
Managing Agents—Ostendorf-Morris Company
Architects—Carson and Lundin, New York
Consulting Engineers—McGeorge-Hargett & Associates

BURNDY

ELECTRICAL CONNECTORS

NORWALK, CONNECT. • BICC—BURNDY Ltd., Prescot, Lancs., England • In Continental Europe: Antwerp, Belgium • TORONTO, CANADA

It's a Breeze!

Just a *Double Squeeze*

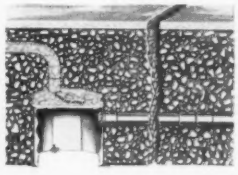
Sets Up E. M. T.

With Original B-M Indenter Fittings

● B-M Indenter Fittings and Tools make an unbeatable combination when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws. Other plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—Smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.

B-M Offset Connector, showing how wires are guided over box edge.

Briegel All Steel Indenter Fittings are U.L. approved as Concrete-Tight.



BRIEGEL METHOD TOOL CO.

GALVA, ILLINOIS

All B-M Indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

BM TELESCOPE SYSTEM

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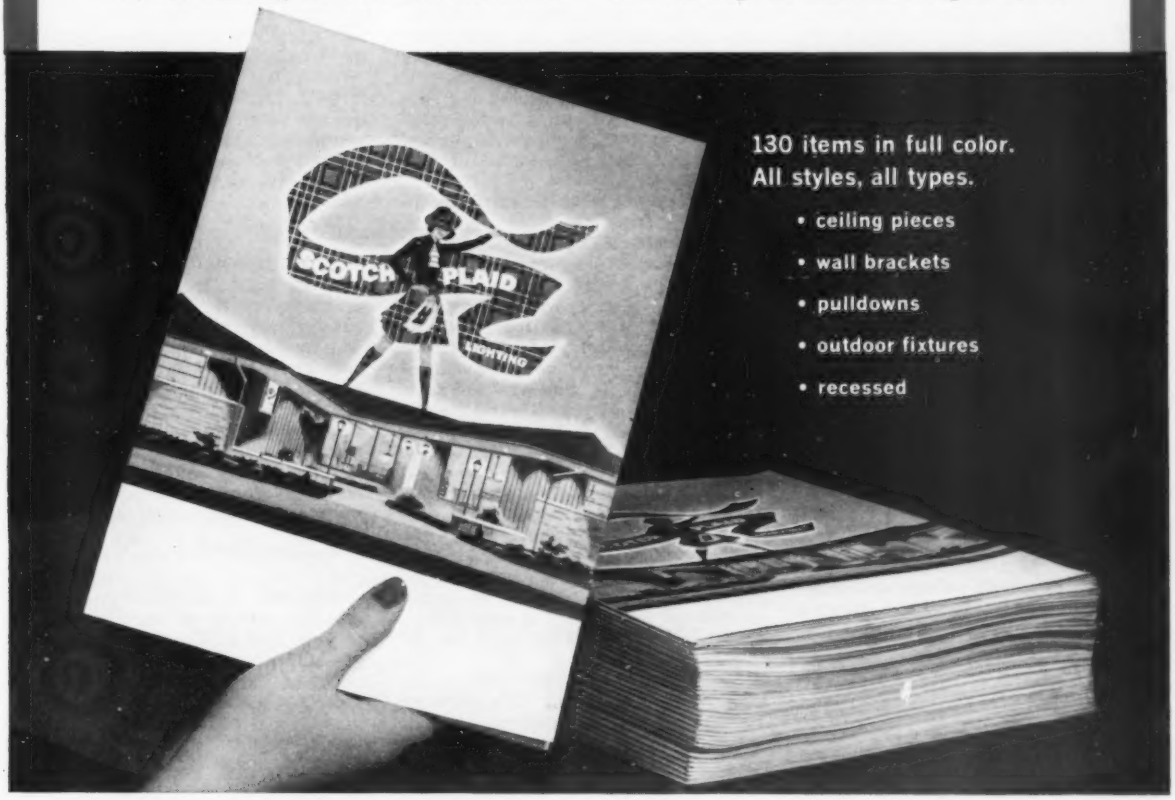
USED THE MOST FROM COAST TO COAST

virden Presents the NEW line of SCOTCH PLAID LIGHTING

Beauty *PLUS* Economy...

From Virden, famous for quality, comes a new and separate line of lighting fixtures. Called Scotch Plaid Lighting, here is beauty in design, excellence in workmanship, at a truly economical price! Ideal for tract homes or low-cost housing. Excellent for remodeling, wherever you want high-style at budget prices. See the new Scotch Plaid Lighting line at your nearby Virden distributor. Ask him for your copy of our new, free, full-color catalog. Or mail the coupon below.



130 items in full color.
All styles, all types.

- ceiling pieces
- wall brackets
- pulldowns
- outdoor fixtures
- recessed

See your Virden distributor or mail the coupon today!

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Virden Lighting, Dept. ES-3
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Please send me your free Scotch Plaid Catalog SP-160.

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City_____ State_____

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Available Free to Readers of Electrical South upon Request

connectors, lugs, neutral bars, crimp lugs, and the Ilsco Lok-A-Blok. The bulletins include descriptive material, dimensions, and packaging data.

Write in No. D123 on card, Pg. 20

TROFFER CATALOG—A 36-page catalog, with complete information on their newly re-designed architectural troffers has been released by Smithcraft Lighting Division, Chelsea, Mass. Divided into sections for selection of lighting units, the catalog gives complete illustrations and data for 1 and 2 foot troffers in all types of ceiling construction. Also included in the catalog is information on ceiling lighting patterns, shielding designs, lighting techniques and applcations.

Write in No. D126 on card, Pg. 20

LIGHTING FIXTURES— Progress Manufacturing Co., Castor Avenue and Tulip Street, Philadelphia 34, Pa., announces the publication of two new lighting catalogs. "Lighting by Progress," a 52-page booklet, describes their line of residential fixtures. "Home Lighting by Minute Mount" is a 12-page bulletin illustrating new ideas in budget lighting.

Write in No. D131 on card, Pg. 20

MOTOR CONTRACTORS — For control of large motors, primary switching of induction furnace transformers, and other high voltage applications, **Allis Chalmers Manufacturing Co.**, Milwaukee 1, Wis., has developed the **high voltage air-break contractors** (type 256A) which are described in a bulletin issued by the company.

Write in No. D132 on card, Pg. 20

ELECTRICAL DUCTS — A brochure is now available from Johns Manville, 22 East 40th St., New York 16, N. Y., describing their line of Transite electrical ducts. The two-color, 11-page, illustrated bulletin contains information on composition, methods of manufacture, applications, costs, and installation. Also included are shipping weights and dimensions of Transite conduit and Korduct.

Write in No. D133 on card, Pg. 20

TRANSFORMERS—R T & E Corp., 1900 E. North St., Waukesha, Wis., has available a bulletin describing Terra-Tran transformers for residential underground distribution. The 15-page booklet is illustrated and contains complete information on construction, application, and design features.

Write in No. D135 on card, Pg. 20

PIPE TOOLS—A new catalog containing dealers' net prices is now available from Nye Tool Co., 4120 Fullerton Ave., Chicago 39, Ill. The bulletin is illustrated and contains information on design features and applications of Nye pipe tools.

Write in No. D137 on card, Pg. 20

RADIANT HEATING — Ceilheat, Inc., 5212 Homberg Dr., Knoxville, Tenn., has announced the availability of a bulletin describing their line of concealed radiant home heating systems. The bulletin includes the principles of radiant heating, installation procedures, and advantages of this heating system.

Write in No. D138 on card, Pg. 20

LIGHTING FIXTURES — A 28-page, illustrated booklet from Lavery and Co., Inc., 15479 Starthern St., Van Nuys, Calif., describes their line of lighting fixtures for western, ranch, early American, homestead, and ranch modern homes. Specifications and catalog data are included.

Write in No. D139 on card, Pg. 20

EXPLOSION-PROOF EQUIPMENT —"An Electrical Engineer Comes to Crouse-Hinds" is the title of a new 6-page folder by Crouse-Hinds Co., Syracuse 1, N. Y. The bulletin describes design and construction principles involved in manufacturing Crouse-Hinds Condulet electrical equipment for hazardous locations.

Write in No. D140 on card, Pg. 20

RESIDENTIAL LIGHTING — A new catalog featuring their line of residential lighting fixtures has recently been issued by John C. Virden Co., 6103 Longfellow Ave., Cleveland 3, Ohio. The 48-page booklet is illustrated and in color. It pictures and describes incandescent and fluorescent fixtures for every room in the house and every design motif.

Write in No. D141 on card, Pg. 20

HYDRAULIC EQUIPMENT—Truck Equipment Co., 3963 Walnut St., Denver 5, Colo., has made available a catalog containing information on their lines of hydraulic derricks, cable reel carriers, and diggers. It is illustrated and contains data on design features, specifications, and application.

Write in No. D142 on card, Pg. 20

WATER HEATING BOILER — Precision Parts Corp., 400 N. First St., Nashville 7, Tenn., has available a bulletin containing catalog information on their electric hot water heating boiler, diagrams of the boiler, and data on the advantages of its use. The boiler comes complete with water circulator and safety valve on models A through K.

Write in No. D143 on card, Pg. 20

FLOOD LIGHTING STANDARDS — An 11-page booklet describing their line of flood lighting standards is available from Kerrigan Iron Works, Inc., P. O. Box 479, Nashville 2, Tenn. Contained in the booklet are catalog data, diagrams of the equipment, specifications, and suggested methods of wiring supply to floodlights, as well as other installation procedures.

Write in No. D144 on card, Pg. 20

CONNECTOR TOOLS—The Thomas & Betts Co., Inc., 72 Butler Street, Elizabeth 1, N. J., makes available catalog D59 including new compression connectors and installing tools recently developed. The tools are for use at usual distribution voltages and for "hot line" applications. New heavy duty tap connectors, double taps, stirrups and single sleeve ACSR tension splicers have many exclusive features and are designed to give high performance and easy installation.

Write in No. D145 on card, Pg. 20

WIRING EQUIPMENT — An abridged catalog of industrial, commercial, and residential wiring items, gives all specifications for such wiring needs as switches, adapters, receptacles, and cord sets made by the Leviton Manufacturing Co., Inc., Brooklyn 22, N. Y. Designed for distributors and contractors, the catalog includes catalog numbers, prices, packing, weights, descriptions and indexes.

Write in No. D146 on card, Pg. 20

CLUSTER MOUNT—Specifications and installation method for the new cluster mount bracket made by Minit-Mount Sales Co., 775 Wooster Rd., N., Barberton, Ohio, are now available in the company's new booklet. Illustrated with photographs and diagrams, the booklet shows in detail how to make safe installations of transformers, capacitor banks, and line type oil circuit reclosers.

Write in No. D147 on card, Pg. 20

LUMINOUS CEILINGS?

we suggest . . .

the "L & P" LINE

U. L. Approved

APPLICATION:

For smart, appealing, shadow-free illumination that covers almost all overhead unsightliness. Modern and decorative for both new installations and remodeling.

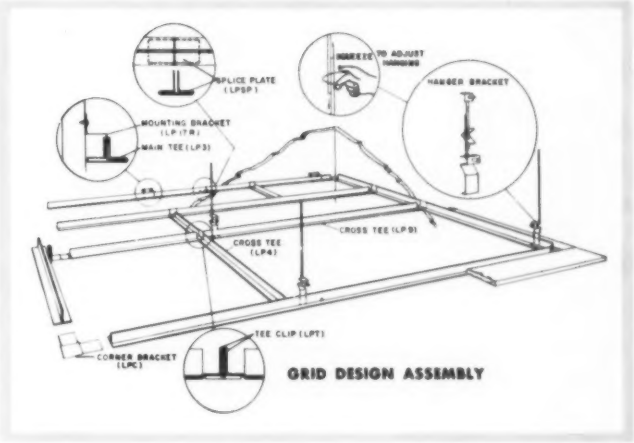
TYPE:

Available in a wide variety of vinyl and styrene plastics in various sizes and patterns, plus louvers (steel or plastic), Honeylite (aluminum) or corrugated continuous plastic. (Write for catalog)

CONSTRUCTION:

1. Suspension System: A complete system for any type of ceiling installation. Specifications designed and manufactured to L&P specifications for easy installation.

2. Diffusers: A wide range of all accepted types, plastic, steel or aluminum.



GRID DESIGN ASSEMBLY

For catalog and price sheets, write or phone today to

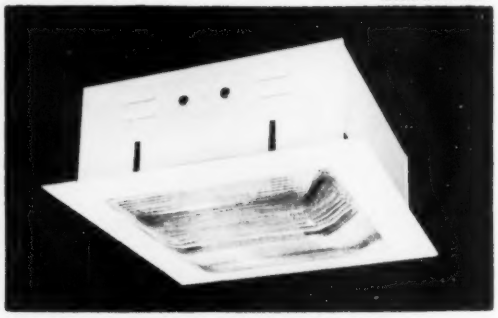
LIGHT & POWER UTILITIES CORP.

1035 FIRESTONE BLVD. • MEMPHIS, TENNESSEE

LIGHTING A CORRIDOR?

Cat. No. 860

. . . we suggest the



L & P DELTA CORRIDOR LITE

All the quality, tested performance and economy that have earned Light & Power an enviable reputation in fluorescent fixtures are also available in the complete L & P Delta line of incandescent fixtures.

For your next corridor installation check these features of the Delta Corridor Lite—specifically designed for corridor lighting:

1. Square recessed fixture, heavy gauge steel housing, baked white enamel finish.
2. Corning asymmetrical lens throws light longitudinally along corridor.
3. Drop hinge frame for easy relamping.
4. 220 V.-660 W. Heavy duty porcelain socket.
5. Fabricated by AFL-IBEW
6. U. L. Approved.

For catalog and price sheets, write or phone today to

DELTA delta incandescent division

LIGHT & POWER UTILITIES CORP.

1035 FIRESTONE BLVD. • MEMPHIS, TENN.

Distributed by Wholesale Dealers Only

LIGHT & POWER UTILITIES CORP. L&P

There's an

L&P

Representative Near YOU!

For further information and prices on L & P fluorescent fixtures—standard or "custom-made"—check the following list, and phone or write the L & P representative nearest you:

N. B. Nichols
2509 Bishop
Little Rock, Arkansas

Craig-Owen
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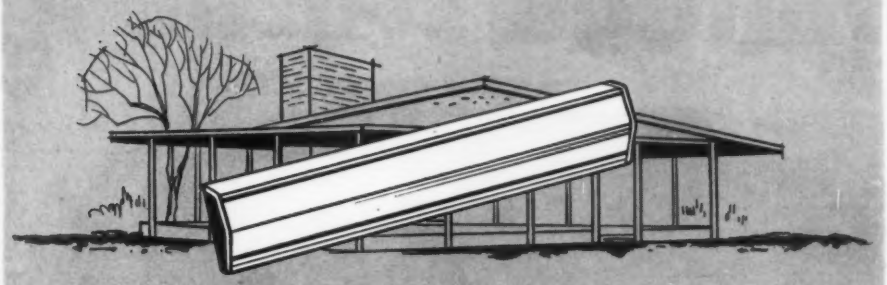

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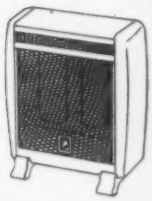

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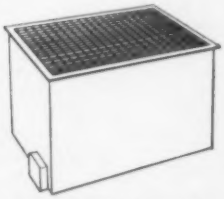

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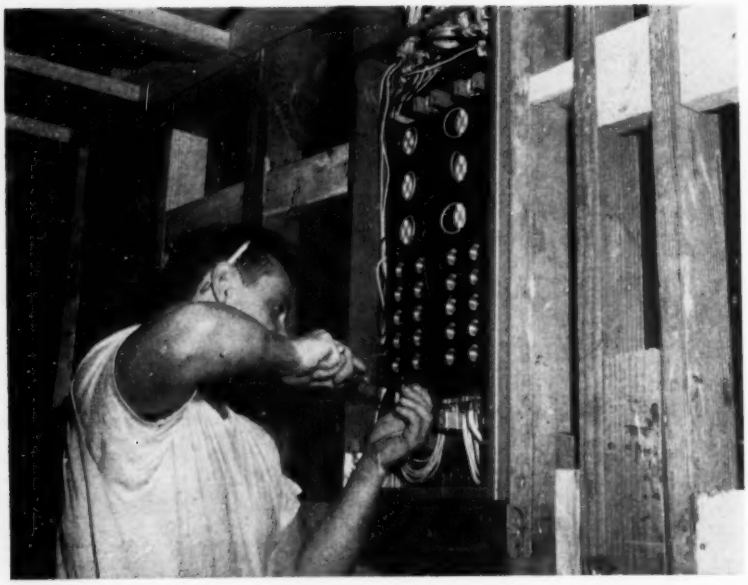
Low voltage switching



The added flexibility of low voltage remote control quite naturally sells the general contractor or owner on more outlets; thus a 200-ampere service is being installed by Baccus Electric in this major revamping of an old home for its elderly owner.

Hank Gay of Sarasota's Baccus Electric, wires up a master that will turn on 7 lights around the outside of this residence, either individually or simultaneously. Conventional wiring on this $20,000 remodeling job was estimated to cost $1,200. Sales effort by Gay in the direction of extra appliances and the advantages of remote control, upgraded the job to $2,000. Says Hank: "Remote control has to be sold. You've just got to talk up its advantages."

By Harry J. Miller

This article should be especially helpful to the following readers:

- Electrical Contractors
- Electric Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ "LOW VOLTAGE, relay-operated wiring systems present a new profit opportunity to be explored," says Florida Electrical Contractor Richard Andrews, presently involved in wiring 15 homes in the $18,000 class for a builder who operates in and around Bradenton.

"Some electrical men are reluctant to get their feet wet in the business of low voltage switching because they fear its seeming complexities and multiple hook-ups, yet it's a simple thing to learn." So says Bill Terrell, of Sarasota, veteran Florida electrical contractor who recently finished a $30,000 masterpiece of remote control wiring in the new modernistic plant of the Kiekhaefer Corp., outboard engine manufacturers.

Adds Terrell: "By installing low voltage remote control, you get away from run-of-the-mill jobs like $7,000 and $8,000 houses; you establish yourself as a contractor in your community who keeps abreast of the latest developments in wiring, and you earn the reputation of having the knowledge and experience to install a wiring system that can be tailored to meet any requirement for residential or commercial and industrial installations."

In the first case, Terrell means residential wiring that permits the fullest safety and convenience for better electrical living. In industrial work, this Sarasota contractor rightly implies that low voltage remote control wiring possesses all the attributes required for installation in the most difficult structural components, and simplifies control methods impossible

paves path to profits

This is the first article in a series of three on low voltage remote control switching. This first article describes the components and discusses some of the problems involved in this type of wiring. The second article will discuss the close relationship between adequate wiring and adequate switching through the use of remote control units. The concluding article of the series will discuss commercial and industrial applications of remote control switching.

or economically prohibitive with conventional wiring.

Hank Gay, superintendant for Sarasota's Baccus Electric, at the moment involved in a $2,000 electrical revamping of a $20,000 home embracing a low voltage system, says: "Low voltage systems have to be sold!" And Kenneth Brumbaugh, electrical engineer with Welchel Electric, says: "It isn't a question any more if a home should be all low voltage remote control or all conventionally wired. Low voltage should be considered in the light of a discretionary tool. In this regard, it should not be shrugged off or bypassed as an unexplored possibility."

Remote control is a system of wiring in which the *control* of the circuit is achieved at a *remote* point from the switch, and this may be at the fixture, outlet, or panel, hence the name. It in no way affects the conventional method of wiring so far as installation, circuitry, calculations of loads, ordinance requirements, etc., are concerned. It only concerns itself with switching methods.

Remote control explained

The remote control wiring system uses two circuits: the regular 120-volt circuits which feeds lamps and convenience outlets, and a lowvoltage (24 volts in some systems; 6 volts in another) in a control circuit for the switches which actuate thermal or magnetically controlled relays that complete the 120-volt circuits.

Thus in essence, it is similar to the low voltage thermostat circuit used for oil-burning furnaces.

But in many relay-operated systems similar to the thermostat controlled oil furnace, the control switch (thermostat), must be held closed and the relay energized all the time that the circuit is ON. The disadvantage of this type of circuit is that it prevents the use of more than one switch for any one circuit. And when it comes to residential lighting, especially, more than one point of control is desirable for convenience, hence the use of 3-ways and 4-ways.

While a stepping type of relay could be used to switch from ON to OFF every time the control switch is pressed, and while such systems are available, the prime disadvantage of these 2-wire, momentary contact switch-control systems is the lack of "absolute" control. For example, if the relay is ON, then the next tap will produce an OFF condition whether this is desired or not. And in order to know if a distant circuit is ON or OFF, a 2-wire system requires a pilot light circuit to so indicate.

Today's modern remote control wiring systems employ three wires to provide absolute control, a condition under which no pilot light circuits are necessary.

Key feature is flexibility

However, since one type of switch takes the place of a single pole, 3-way or 4-way, and small #18 wires are bunched together to form the switch legs carrying the 24 volts (6 volts in the case of Remcon) to actuate the relays which close the 120-volt circuits, a degree of flexibility, control, convenience, and economy is attained which makes low voltage a primrose path to profits for the contractor.

With low voltage remote control, horse-and-buggy switching of lighting and appliance loads in homes, commercial buildings, and factories is passing.

A relay, either magnetic or thermal, which actually switches the load is mounted in a ganging box, or the conventional outlet box, and the #18 wires leading from it may be connected to and controlled by, any number of low voltage switches conventiently located and operating off a 3-wire low voltage system. To achieve this multipoint control, all that is necessary is to wire all switches in parallel to the relay. They are all momentary contact type and so are actually in the circuit only during the fraction of time they are pressed.

Thus in systems that use a two element relay, with one line feeding their common junction and the other the common terminals of the switches, pressing the ON side of the switch flips the circuit on via one element actuating a plunger or trigger. Pressing the OFF side of the switch actuates the second element to move the plunger or trigger away and break the circuit.

A transformer furnishes the low voltage, and may be either the type built into the relay or an external type.

Because low voltage remote control utilizes only one type of switch to perform all switching functions, current-carrying conductors need not loop down to the switches or make lengthy runs to permit multi-point control. Instead, they are carried straight as the crow flies direct to the

outlets where they are intercepted by the relays, while the smaller, low-cost #18 wires make the numerous switch loopings.

In turn, this means shorter runs of non-metallic or metallic sheathed cable, conduit or EMT.

How to get started

According to Contractors Terrell, Andrews, and Mathues, the contractor who essays to enter the field of low voltage remote control should kick off his efforts by wiring it in a low cost home. Says Andrews: "A contractor may count himself lucky if he breaks even on his first such job, but the experience is well worth it. By the time he gets through with it, circuitry will no longer be a mystery to him, and he can then tackle the larger homes."

Some contractors assert that even in "minimum" systems where any saving on multipoint switching is not a factor, remote control is still worth its slight extra cost since it makes a conversation piece for the home buyer and a prime selling feature for the builder. And many an attractive remote control wiring systems, with its dramatic operation and distinctively modern switches and wall plates, is sold on appearance alone.

Numerous advantages

Contractors list many advantages for low voltage wiring, its relay operation being similar to that long in use by industry in the control of elevators, machine tools, motors, etc.

For example, some systems employ electrically operated master controls operating from 25 to 32 electrical circuits at the touch of a single switch. With remote control, the contractor can offer such extensive switching and flexibility more economically than with 3-ways and 4-ways of conventional wiring. The resulting system meets the demand of modern electrical living since it begets a system that assures against electrical obsolescence. Thus the contractor can offer extra "housing-selling" features at small additional cost.

Components are few and are made by the country's leading electrical manufacturers. (General Electric, Remcon, Square D, Bryant, and Touchplate.) Such components include low voltage relays, control switches, manual master selector switches, electrically operated master control contractors, and a few other accessories.

Installation problems

The a-c rated relays are designed so they may be readily removed when necessary without disturbing the finish of the building, and contractors find it time-saving to install these after plastering has been completed in order to prevent damage from other tradesmen on the job. This prevents the possibility of energizing the coils for long periods of time during the plastering operation. For example, if the switch leads were all shorted on two-coil units, this would mean that both of the relay's coils would be energized all during the plastering operations. This would impose a heat problem on the relay and might cause premature burnouts.

Control stations are generally installed at every entrance to every room and at other places designated by the plan. These are mounted either in mounting brackets supplied by the manufacturer or in four-inch square plaster rings which are fastened to the studding.

In the case of a remodeling job, placement of relays depends on the extent of the remodeling job. In some cases it may be more expedient to gang them together. This saves installation time, makes a more orderly arrangement for checking circuits and relays, and facilitates later changes of switch and relay controls.

Another advantage of the ganged method of mounting lies in the fact that relays are prone to give out with slight clicks, and coils may develop an occasional and objectionable momentary hum when switches are activated. Since gang boxes are generally installed in out-of-the-way locations, these objections are eliminated. This is no longer an important factor as the thermal type unit does not have this difficulty and the other manufacturers use rectifiers or d-c power packs to eliminate hum.

Where relays are to be mounted in outlet boxes, attention must be given to Code requirements limiting the number of wires in box when box also contains fittings or devices (See Section 370-6).

In the ganged-boxing, the location for the gang box should be such as to minimize the runs from the box to outlets to be controlled. Where the wiring is to be split into zones, several gang boxes may be required and these are available for 6, 12 or 18 relays.

The contractors who are finding low voltage remote control a profit-producer, feel it is admirably suited to remodeling work.

The small #18 parallel conductors are readily pulled through partitions, around corners, or through conduit and EMT without damage to their plastic or cotton insulation. While brick, concrete, or cinder block construction poses a problem with conventional wiring, since space must be provided to set deep boxes with multi control, the #18's are no problem as they can be tacked to furring strips or buried in plaster.

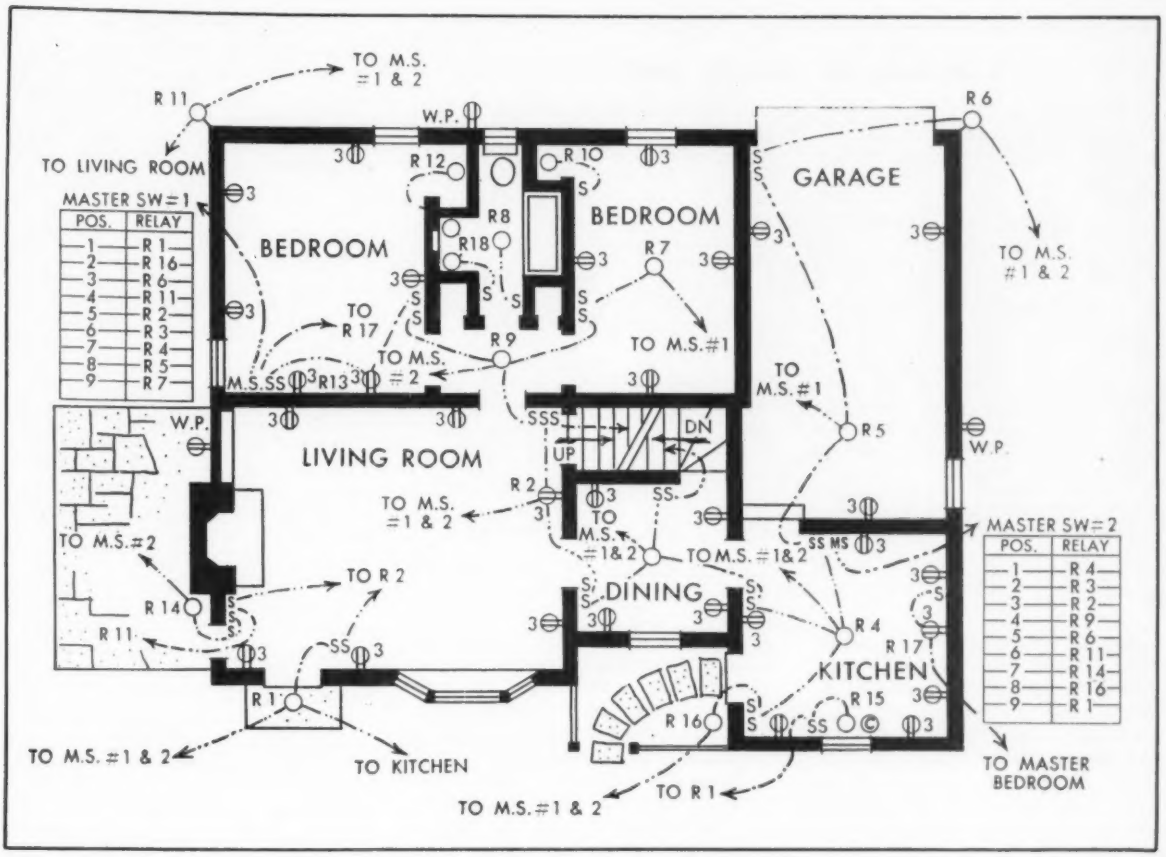
The low-voltage wires can be run behind moldings and fished through spaces impossible to hold metallic or non-metallic sheathed cables. Since only ⅝ inch depth is needed for switch assembly, switches may be conveniently located in cabinets, on slide-door pockets, window mullions or just about any other desirable or convenient location.

In old work destined for remote control, where conventional single pole switches are to be replaced by multi control switching, it's a simple matter to remove the single-pole switch, replace it with a relay with its 120-volt leads connected to the switch ends, then bring the low-voltage switch legs around to the various low-voltage switching points. Finally, the original switch box is covered with a blank plate.

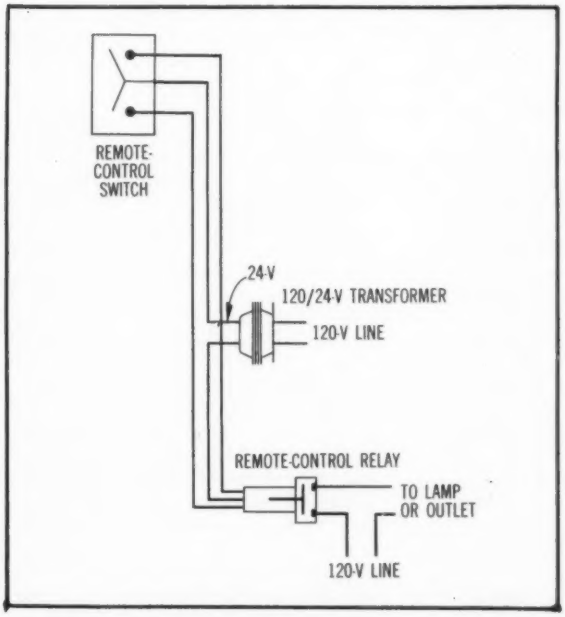
On the other hand, it may be more advantageous to install the relay right in the outlet box and utilize the old 120-volt switch conductors for the low voltage switch leg. All that would be needed here is to run one more conductor of #18 wire down to the old switch location and then install the low voltage switch.

Sales opportunities

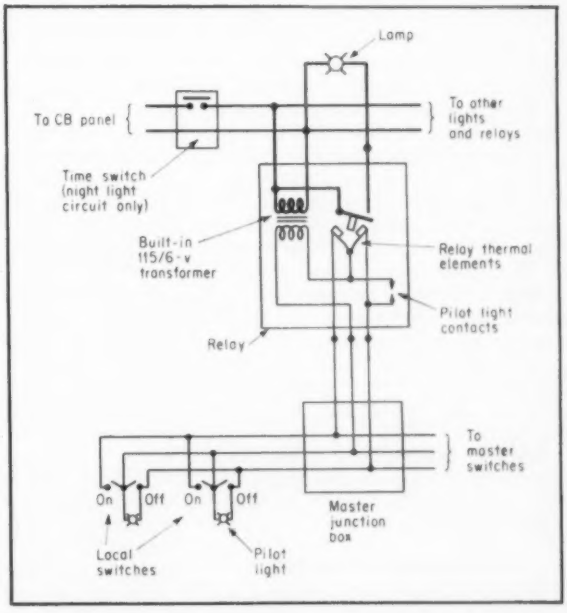
Aside from remodeling type of construction, there are many opportunities for the electrical contractor to sell an installation where a single relay may be involved. One of these, for example, is the postlight. When such lights are installed after the home is completed, the work is often simplified by using a low voltage relay since the running of cable to the front door location and the cutting in of a switch box will be eliminated. The contractor need only cut a hole large enough for his low voltage switch and fasten it with two screws. If it is too difficult to pull the #18 wire through the wall, he may run it along the baseboard or bury it in the surface of a plaster wall.



This wiring layout for a small home demonstrates the advantages and flexibility of low voltage remote control switching. The installation shown here calls for the installation of 18 remote control relays, 33 switches and two 9-position master switches. Local practice may require some changes.



This sketch demonstrates the operating principle of low voltage system using single transformer.



One type of low voltage remote control relay has a small built-in transformer in each relay.

Bulletins on remote control

Readers are invited to use the postage-paid inquiry card on page 20-A to obtain copies of any or all of the following bulletins, manuals, and catalogs on low voltage remote control switching devices:

Bryant Low Voltage Multi-Control Wiring System Manual	**Write in S-301**
General Electric Technician's Manual on Remote Control Wiring	**Write in S-302**
General Electric Catalog of Remote Control Wiring Components	**Write in S-303**
G-E Bulletin "How Modern Wiring Helps Sell Houses Fast"	**Write in S-304**
Remcon Electricians' Manual on Remote Control Switching	**Write in S-305**
Remcon Catalog of Remote Control Switching Components	**Write in S-306**
Remcon Reprints of Remote Control Switching Applications	**Write in S-307**
Touchplate's Selected Literature on Remote Control Switching	**Write in S-308**

Another single relay type installation which the electrical contractor can sell advantageously involves attic fan control. When an electrical contractor installs an attic fan with a motor rated ½ hp or less, he has the opportunity of "selling up" the job by offering remote switching from several points.

The advent of intercom systems in homes offers the electrical contractor another such opportunity. Most such systems must be turned on and off at the central unit location, but the application of low voltage remote control switches at each remote speaker location makes it a simple matter to activate the unit from any point in the installation, thus giving the system added flexibility.

Another sales opportunity is to be found in a closet light relay offered by one manufacturer. For this two-wire unit, the contractor needs only to drill a ¾-inch hole in the jamb and set the control button in it. If a double door or sliding door set is involved, buttons may be set in both door jambs so that no matter which door is opened, the action will activate the relay and turn on the light.

Such is the kind of work that low voltage remote control systems make possible and economically attractive.

Transformers required

Interviews with electrical contractors and consulting engineers brought out some difference of opinion with respect to the number of transformers required and the most advantageous location for the transformer. (This does not apply, of course, to the Remcon relays, each of which includes a small built in transformer.)

Generally speaking, regardless of the number of relays installed, one transformer will be found adequate; nearly 100 relays have been served satisfactorily in some instances from a single transformer. But where the job is of considerable magnitude with long runs and many electrically operated master controls, some contractors prefer to use two transformers in order to "save future call-backs" as they say. Some have reported that lengthy runs may cause voltage drop and occasional failure of relay operations.

However, the contractor should be completely familiar with the requirements of the equipment he is installing. The equipment of some manufacturers is suited to longer runs than that of others. Some installations have been made, for example, where almost 100 relays were employed with two electrically operated master control units and some eight master-selector switches and all are operated satisfactorily from one transformer.

Electricians find that additional transformers are generally needed for farms, commercial establishments, schools, hospitals and comparable installations.

In the outlet box method of wiring, the transformer is usually installed in either the attic or basement, in a central location.

In gang box mounting, it is better practice to locate the transformer close to one of the gang boxes so that the low voltage supply circuit runs will be of minimum length to the relays. For most practical purposes, the average home requires only one transformer.

In one make of relay (Remcon), a thermal element is used. When six volts is applied a bi-metal strip expands and closes the 120-volt contacts. Pressing the OFF side of the button completes a similar cycle on that side.

These relays have been designed by the manufacturer to "lock" in the open position when temperatures reach 175 degrees F. This characteristic is built in as a safety protection. If the relay should become shorted on the low voltage side, a bi-metal strip will heat up and expand upward, putting the relay in condition called "safety." However, once the short is removed, the bi-metal strip cools off and once again the unit will switch the circuit normally.

Accordingly, electrical contractors must use some judgement when planning the installation of these relays in a fixture outlet box where pan-type fixtures are used and ventilation is not provided. In such instances, temperatures may exceed 175 degrees F., and the relays would not function properly. In such instances, the relay can be installed in a floating box.

Other problems

In the case of all types of relays, it is essential that the contractor guard against the possibility of shorted low voltage switch legs which will keep relay elements energized for a long period of time and may damage the relay. Accordingly, wire with good insulation should be used. The contractor should be careful that the low-voltage wires at the switch location do not touch, the low voltage switches should be installed preferably after all paint work has been completed. This is to insure that paint does not get into the switch and cause it to stick.

In a system that utilizes a master transformer, it is usually suggested that the master transformer be not energized until all switches have been installed. This is to prevent tradesmen from twisting the low voltage connectors together in order to turn on a light, a practice frequently followed in the case of conventional wiring.

(Continued on page 124)

Here are two good examples of illuminated ceilings found in Memphis. (Left) Cashier's area at Memphis Light, Gas and Water Division offices. (Right) Same type double pan system at Levy's Mens Store.

Tips on luminous ceiling design

By Murray Reiter

President
Light & Power Utilities Corp.
Memphis, Tennessee

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

◆ REAMS OF INFORMATION are available on the application, design, and installation of the lighting industry's newest innovation, the illuminated ceiling. It is remarkably comfortable, more efficient than most people think, and costs less than some of the other lighting systems. However, so far as we know, nobody has released a simple check list of things to do and things not to do when considering an illuminated ceiling.

Here is a list of "do's" and "don'ts"' which our sales force has found particularly helpful.

Things to do - - always

(1) Use a plastic which is known to be free from discoloration.

(2) Recommend an illuminated ceiling where freedom from shadows is important.

(3) Check with building code authorities before going too far.

(4) Insist on a base ceiling which is as free of obstructions as possible.

(5) Insist that the ceiling over head be painted flat white with a reflection factor of at least 80%.

(6) Space the lamps not more than one and one half times the distance from lamps to plastic, and one half this distance from ends and sides of plastic area.

(7) Seal all cracks above the plastic. The "plenum" (or cavity) above the plastic must not be open on top or sides. An opening may permit dust deposits and it may cause the plastic to rattle from the air currents.

(8) Make the plenum shallow. Twelve to 24 inches is ideal.

(9) Use b a r e lamp strips mounted against the ceiling above the plastic.

(10) Insist on light (50% to 70%) walls, light (25% to 35%) floors and non-glossy, light desks (35% to 45%).

(11) Use white cotton gloves when handling the plastic panels.

Things to do - - usually

(1) Provide additional sound absorption materials in the work space if noise is a problem.

(2) Use 48-inch rapid start cool white lamps, preferably having pushtype sockets. (For easier maintenance).

(3) Recommend a proven plastic cleaning technique.

Things to do - - never

(1) Never mix solid plastic pans with louvers on ceilings. Foreign matter can go up through the louvers and settle on the plastic.

(2) Never use 96-inch lamps unless you know they can be removed easily because some combinations of cavity depth, height, etc., make servicing virtually impossible with the 96-inch lamp.

(3) Never recommend illuminated ceilings in non-air conditioned spaces. Unfiltered air is too dirty in most cases.

(4) Never recommend air discharge diffusers above the plastic. There is too much chance of dirt deposits.

Motor maintenance case histories

By C. T. Baker

Consulting Engineer
Atlanta, Georgia

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers ✓
- Consulting Engineers

◆ Most motor maintenance is routine and requires only careful attention to details such as insulation resistance, proper lubrication, rotor clearance, etc. Occasionally, however, the industrial electrician or electrical contractor engaging in motor maintenance work will encounter problems which will really tax his ingenuity and knowledge of motor circuits to the utmost. Here are three examples which recently came to the attention of this writer.

The puzzling case of the lame motor

In this case, a 35 horsepower, 3-phase, 60-cycle 220 volt, wound rotor type motor drove a 7½ x 7½ inch refrigerating compressor. The compressor was operated about 20 hours per week as required during peak load periods.

While making a survey of the operations of this plant, which included a check of all motors, I discovered that this particular motor was operating as a single-phase unit.

Since no trouble had been experienced when starting this motor-compressor assembly, even though the compressor had to accelerate under partial load, the question that arose was: how could the motor start and come up to speed as a single-phase unit.

Later, when the oil tank enclosing the control equipment of the motor was removed to permit an inspection of the control mechanism, the mystery was cleared up. Actually, the motor started as a three-phase unit and did not "go single-phase" until the control handle of the starter had been moved to the point of extreme travel and made permanent running contact with the stop post of the controller top section.

Due to a short in the control mechanism of the control assembly, the motor was made to operate single-phase as soon as the controller handle made contact with its running position.

After the trouble had been cleared up, the motor operated as a three-phase unit. The motor was an old one, as was also the drum type controller, and was second hand when installed at its present location. No one knew how long the motor had operated at its original location as a single-phase unit or to what extent the insulation may have been injured as a result of overheating.

Case of neglected ventilating fan

A ventilating fan driven through a V-belt by a 5 hp motor was installed in a meat packing plant to provide ventilation in the non-eatable processing room.

Due to the nature of the operations in this department, considerable water vapor had to be removed by the fan along with the heated air. After about a year's operation, the fan bearings began showing signs of distress. Later, due to the eratic performance of V-belts, the motor bearings also became somewhat noisy.

When the unit was shut down to permit of an inspection, the cause of the noisy operation was soon apparent. The fan blades were covered with lumps of refuse held together in the form of hard cakes by the cement action of grease and air borne particles, and so distributed over the fan blade surfaces as to produce a badly unbalanced fan rotor—a defect that requires but little time to seriously damage the supporting bearings.

The fan bearings had to be replaced because they had taken such a hard beating that they could not be re-conditioned. To insure operation free of future trouble of this sort, the fan blades are cleaned every week end.

Synchronous motor with low power factor

Synchronous motors are widely used to drive refrigerating compressors. In some instances the motor rotor is mounted on the compressor shaft and some times the motor is belted to the compressor shaft. Generally, such motors are designed for unity power factor operation. Unity power factor motors develop maximum over-all operating efficiency when operating at unity.

However, in far too many instances, in order to hold the price down, only a skeleton set of instruments are furnished with the motor starter panel. To be fully complete, the starting panel should be equipped with the following: a-c and d-c voltmeter; a-c and d-c ammeter; power factor meter; and frequency meter.

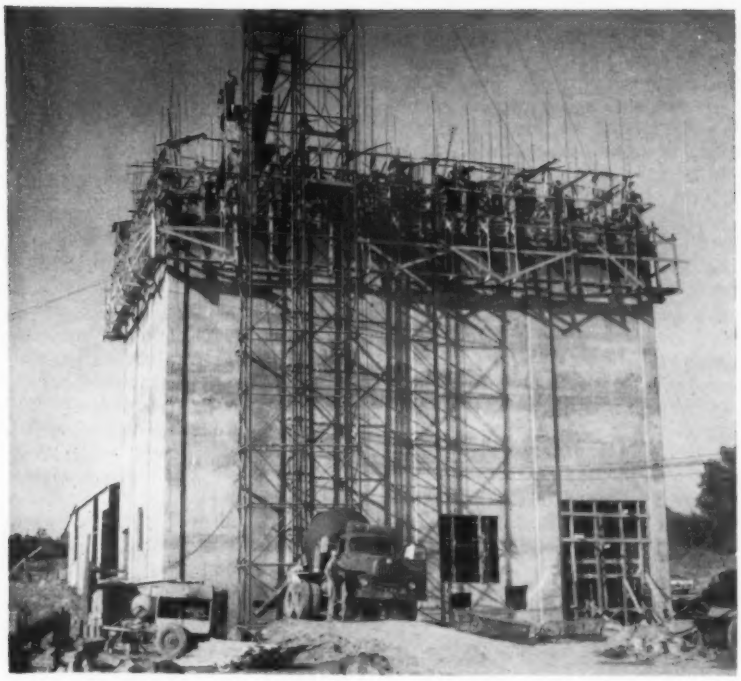
Admittedly, this complete complement of instruments will add to the over-all cost of the installation, but when prorated over the life of the motor, the added cost is not significant. Without a complete set of instruments, the plant engineer must operate largely by guesswork—a poor practice.

Some time back, the writer investigated the mechanical and electrical equipment in a large cold storage plant. The largest motor was a 125 hp synchronous motor arranged for direct connection to a refrigerating compressor. The motor was rated 3-phase, 60 cycle, 2,300 volts, 300 rpm, unity power factor. This motor was operating at 80 per cent power factor.

A check with the manufacturers of this motor developed the following facts. When operated at 80 per cent power factor at full load, the efficiency of the motor was 1.7 per cent below what it would be at unity power factor. At three-quarter's load the efficiency at 80 per cent power factor was 1.5 per cent less than at unity power factor, and at half load the loss in efficiency was 1 per cent.

Obviously, when the annual cost of power seldom falls below one and one-half cents per kwh, as was true in this particular case,

(Continued on page 124)



This 48 x 64-foot form for pouring concrete "floats" upward on power from 131 electric motors. A 24-hour-a-day construction schedule let workers pour 174 yards of concrete a day for the 16 stories.

The tub at center, located on the rising form, applies hydraulic principle to regulate the 131 motors.

Electric automated forms aid construction industry

By W. M. Massey

This article should be especially helpful to the following readers:

- Electrical Contractors
- Electrical Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ AUTOMATION through electricity to aid the general contractor is aptly illustrated in the construction of the new feed mill being built by Pillsbury Company at Jasper, Ala.

For the 48 x 64 ft. materials storage tower, reaching a height of 162 ft., the form for pouring concrete was elevated automatically from top to bottom by electric motors. From the base of the structure to first offset, near the top, a total of 131 electric motors were used to lift the honeycomb form for the outside walls and interior partitions. Concrete was poured at rate of 174 yards every 24 hours until the 3,000 yards for the job were poured.

Each motor was one-twelfth horsepower with gear ratio of 9,956 to one on hydraulic principle that made the lift by climbing total of 131 reinforcing rods set in the concrete as the pouring progressed.

All motors were synchronized for the lift by the water level in a central tub. Rubber hose lines led from the central tub to the float on each motor that activated the individual relay switches. Electric elevator lifted the ready-mix concrete from trucks to form level where it was distributed in wheel barrows.

A total of three maintenance men, working in alternating shifts looked after the 131 motors on the round-the-clock construction that could not be halted for weather or any other reason that would allow the concrete to set prematurely.

Over the old method of hand cranking the individual lifts, the motors saved the labor of about 20 men per 12-hour shift. But on this particular job, where the master form was honeycombed by cross walls to form storage bins, the use of extra men would have been almost impossible due to lack of space.

The equipment used in raising the forms is manufactured and owned by the Double J Manufacturing Co., 1141 S. 12th St., St. Louis, Mo. It was rented to the general contractor.

Another phase of automation will be effected when the machinery is installed in the new mill. Grinding, mixing, weighing, measuring, loading and unloading will be on a push-button basis. Jackson Electric Co., Birmingham, is electric contractor for the mill wiring.

'Copter cuts costs as electricians go up for business

By Bill R. Clary
Hallman Electric Co.
Oklahoma City, Okla.

◆ WE COMPLETED what would normally have been a three-day phase of a job in a matter of a few minutes by using a helicopter to lift a beacon light into position.

Our recent contract for the installation of new beacon lights on water towers at Tinker Air Force base included the placement of a 24-inch duplex rotating beacon atop a 123 foot tower, as well as laying some 5,000 feet of underground cable. The light weighed about 400 pounds.

The neon lights of growing Midwest City, adjoining Tinker, were causing confusion with the green and white beacons of the base, making them useless to pilots at night. The flying safety officer asked for beacons to be placed on a tower two miles to the southeast.

Our first thought on getting the light into position was the usual sub-contract with a local steel erection company. But the prices that we got from them seemed excessive, so we started kicking around ideas of different ways the light could be lifted. Then we came up with the idea of using a helicopter.

No copters were available locally, so we contacted the Allied Copter Service of Tulsa. We found they could do the job for considerably less money than the steel company had quoted us, and that they could do it whenever we were ready.

The extent of our being ready simply meant advance construction of the foundation for the light on top of the tower, which we had a welder do for us; making appointment with the helicopter service—subject to weather conditions; and having three men on top the tower to receive the light. We found that two men could easily have handled the job.

The 400-pound beacon was attached to the sling of a Bell 47-G helicopter and lifted into position over the tower in about three minutes. The beacon was received by our men and secured to the foundation by putting three bolts in place. The conventional handling of this would have required building steel scaffolding and using a 150-foot boom to handle the light, three days work at the very least. By using the helicopter, we saved about $500 on an $800 job.

Since this was the first time that a helicopter had been used for construction purposes in the Oklahoma City area, we got some valuable publicity through television news coverage showing the placement of the beacon.

The evident saving of time and money has started us thinking of other jobs in hard-to-reach areas that could be done most efficiently by copter service. The helicopter would be very good for use in hilly, rocky or inaccessible places as well as on high tower jobs.

This installation was observed by base officials, and it was in nature of a test for them as well as us. We have also had numerous calls from other electrical and construction contractors about our experience.

Two-way radio boosts efficiency

By Ben Prichard
President
Prichard Electric, Inc.
Gulfport, Miss.

◆ A TWO-WAY radio system is being installed between our office and the trucks of our on-the-job working teams; and though our company is relatively small and the system will cost about $4,000, we are convinced it will pay for itself in improving our operating efficiency.

To pay for the system, we plan to add the cost to our job estimates, since the jobs will benefit as much as we do in prompter, better service.

Our company will benefit from a reduction of lost time and better utilization of manpower and equipment. Our employes will benefit from incentives to greater productivity that closer supervision will give them. They want

Hallman Electric Co., of Oklahoma City, completed what would have been a three-day job in a matter of minutes by utilizing the services of a commercial helicopter service. The copter lifted the 400-pound beacon light to the top of a water tower where electricians quickly bolted it in place and completed electrical connections.

Ben Prichard, of Prichard Electric Co., Gulfport, Miss., keeps in close touch with his crews with this two-way radio system.

to do as good a job as possible, and they like the idea of faster communications.

After the system is in operation, its only cost will be for equipment maintenance, and the more it is used the less its unit costs will be. We operate three trucks now and hope to add others. A single radio transmitter will serve all of them, and the additional trucks will require only their receivers.

We got the idea from the ever closing gap between costs and profit. When cost records showed we were paying 20 cents a mile to operate each of our trucks, plus much more for the workmen's time during their operation, we were able to identify and isolate a major cost problem. On some jobs, especially the smaller ones, we found our workmen using at least a fourth of their time in transportation.

Until we seriously looked into a two-way radio system, we had tried job tickets, time reports, and use of the telephone between office and workmen. Somewhere along the line each of these practices fell short of the desired results.

I realize this is not a brand new idea. Several contractors along the Mississippi Gulf Coast are using it with apparent success, and it is most likely also in use elsewhere. However, our big question was whether or not we were big enough to justify the initial cost. I believe we are. In one way, the smaller the operator, the more radio will pay him by increasing the efficiency of limited personnel and equipment. A larger contractor might even save by a reduction in the number of his working teams.

Blackboard job control record helps to keep work on schedule

By Frank M. Becker, Jr.
President
Becker Electric Company
Alexandria, Virginia

◆ IN ORDER to keep materials on a job flowing smoothly so that there will be no delays to obstruct coordination with other trades on the job, we have placed on our wall a 3-foot x 6-foot blackboard, which provides us with a complete picture of the facts on current jobs in construction.

Covering about 10 or 11 jobs in progress, the record is a constant reminder that we have to keep pushing continually, and following up, in order to keep abreast of our schedule. Competition is too keen these days to leave anything to chance. The blackboard keeps us posted on the history of each job, saving us time and labor which affect our profit and loss.

Listed on the blackboard are job name, job number, telephone number, job superintendent, materials ordered, from whom, date ordered, when delivery was scheduled, materials received, date, permit number, fixture allowance, meters. Any breakage or materials damage is also recorded. Entries on the blackboard take no more than 15 minutes per job, but it is time well spent because the board proves a source of information to our job superintendents, supervisor, and to me.

At board meetings of our job superintendents, time is saved when they do not have to inquire about follow-up of certain materials. The latest bulletin has been entered for their benefit.

By looking at the board, I know at any time how a job is progressing. Panels, boxes, switches, etc., are going to be on hand in ample time to avoid delay. Our schedule of delivery is set up when the

(Continued on page 123)

Important details on all electric jobs in progress are recorded on this blackboard by Becker Electric Co., of Alexandria, Va. Mr. Becker reports that it has proved valuable in keeping work on schedule.

Know the law

by Arthur L. H. Street

Workmen's compensation rules did not apply

◆ IN PRODUCING aluminum, a large company generated electric energy exclusively for its own use. The company employed electricians in the maintenance of existing installations, but none of them were engaged in the construction of a new aluminum producing plant. That work was done by an independent contractor, who sublet electrical installations to a subcontractor. Plaintiff, a journeyman electrician, was employed by the subcontractor and was injured allegedly through negligence of the aluminum company.

Was plaintiff entitled to sue the aluminum company for damages, or was he limited to a claim for workmen's compensation under Louisiana law?

The Louisiana Court of Appeals, New Orleans, decided that plaintiff's suit for $370,775.20 damages had been erroneously dismissed by a trial court (Ball v. Kaiser Aluminum & Chemical Corp. 112 So. 2d 741.)

The Court of Appeals decided that for purposes of a statute providing that when any person undertakes to execute any work which is a part of his "trade, business or occupation" and contracts with any person for the execution of the work, he shall be liable to pay workmen's compensation for injuries sustained by employees performing the work; that the erection of an aluminum plant, entrusted to a contractor, was no part of the "trade, business or occupation" of the aluminum company; and that the electrician employed by the subcontractor of such contractor, who was injured in performing construction work, was not limited to a claim for workmen's compensation and sued for damages instead.

In short, the workmen's compensation law would have applied to a claim against the contractor or subcontractor because claimant's services were rendered in the course of their "trade, business or occupation." As to the *aluminum company*, the law would also apply to claims for injuries to its electricians employed in *maintenance* of its electrical equipment, but not to employees of contractors engaged in construction of a new aluminum producing plant.

Job defects and damages chargeable to contractor

◆ IF DEFENDANT, a contractor, installed a defective air-conditioning system in a home and the home-owner employed another air conditioning contractor to eliminate defects in the system and to repair damage to ceiling caused by defects in system, defendant contractor was liable both for costs of repairing defects in system and for damages caused by defects. So decided the Louisiana Court of Appeals in the case of Filiberto v. Conditional Air Co., 112 So. 2d 748.

The Court of Appeals said that whatever caused the trouble, almost immediately after the completion of the installation, the system began to give trouble, and the defendant was called upon very often to eliminate faults or defective operations. Owner employed another air conditioning company to attempt to remedy the situation. Basic changes were made in parts of the system and as a result the system seemed to operate properly.

City's license denial upheld by the courts

◆ WHEN A BOARD is entrusted by law with passing upon the qualifications of one to serve the public as a master electrician, the courts will be "extremely reluctant" to interfere with action by the board in finding that an applicant has not passed a satisfactory examination.

So decided the Florida District Court of Appeal, First District, in the case of State v. Board of Electrical Examiners, Jacksonville Beach, 101 So. 2d 583. The court approved action of the defendant board in refusing to issue a certificate of competency to an electrician.

Defendant city's Code provided:

"(b) Examination and certificate of competency. The board of examiners shall examine all applicants desiring to work at the trade or business of electrical construction . . . The board . . . shall have the right to establish and promulgate rules and regulations for the investigation, application and examination of all electricians doing business in the city . . . Examinations shall be made in whole or in part in writing and shall be of a practical and elementary character *but sufficiently strict to test the qualifications of the applicant and to satisfy the board as to the applicant's ability . . . If satisfied as to the competency of such applicant the board shall issue to him a certificate of competency . . .*

"(c) Scope of examination . . . Examinations of master electricians shall be . . . more broad and technical in scope [than those for journeyman and maintenance electricians] and may cover details of construction which are not fully covered by the National Electrical Code or the provisions of this article . . ."

The evidence showed that all examination papers were graded according to uniform rules. Questions taken from the National Electrical Code were graded according to answers given in that Code. The Code and another authoritative text book, etc., were used in grading other examination questions.

Nearly two years after the Board "flunked" applicant, grading him 70.04%, the City's consulting engineers unofficially reported, on studying the examination papers, that applicant was entitled to a passing grade of 80.16%. But the evidence showed that this result was reached by giving applicant the benefit of the doubt in grading his answers to questions which the engineers considered as being capable of "more than one interpretation." The city electrical engineer also thought that applicant was entitled to a passing grade but his method of grading

(Continued on page 122)

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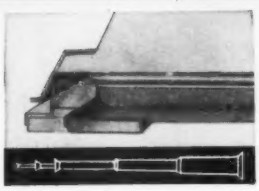

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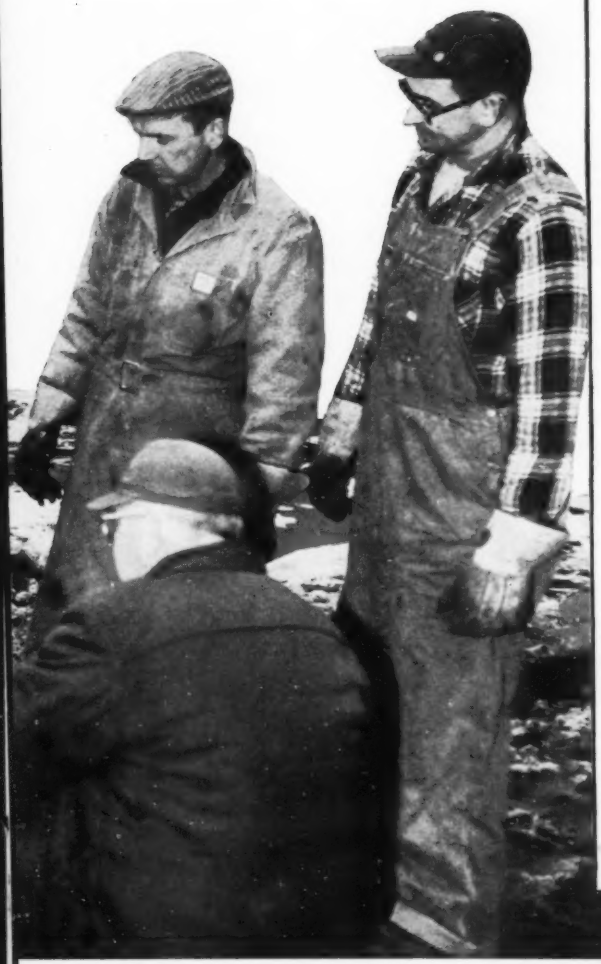
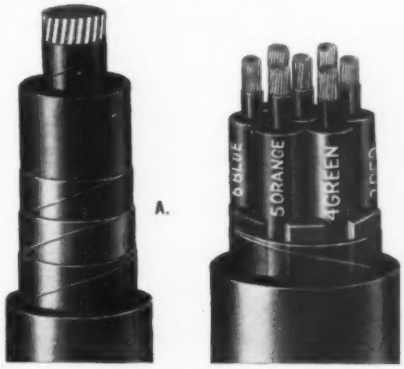


This recently completed IBM Branch office at South Bend, Indiana, handles the load of Data Processing Machines servicing nine counties in Northern Indiana and Southern Michigan.



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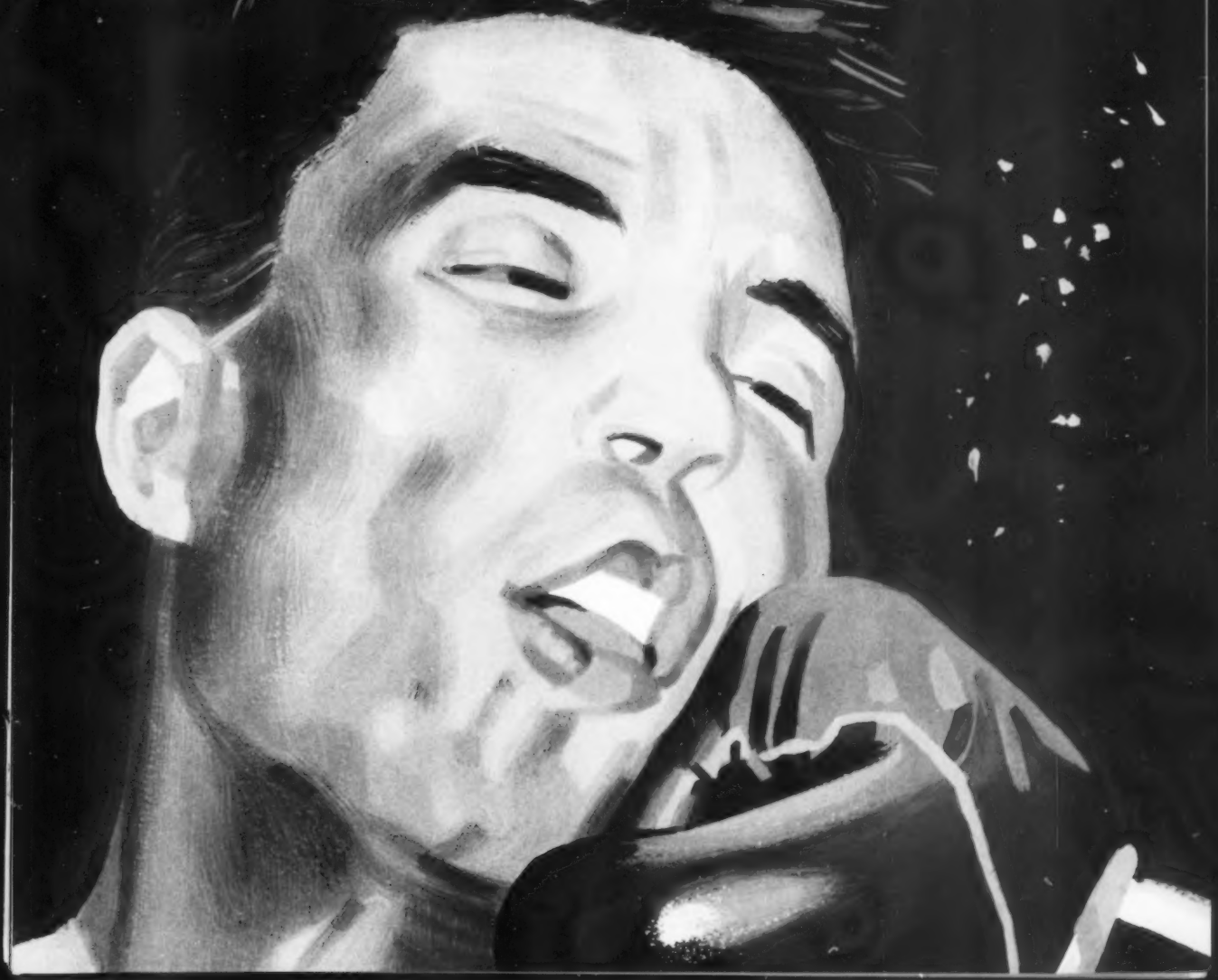

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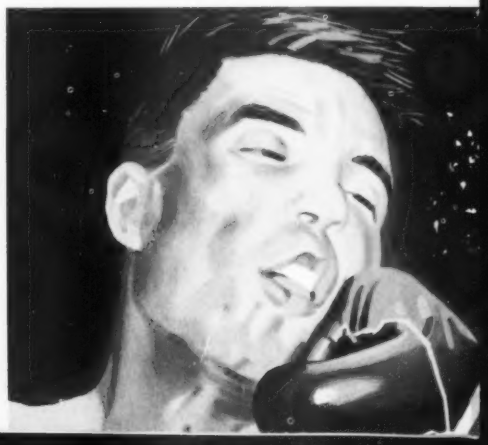

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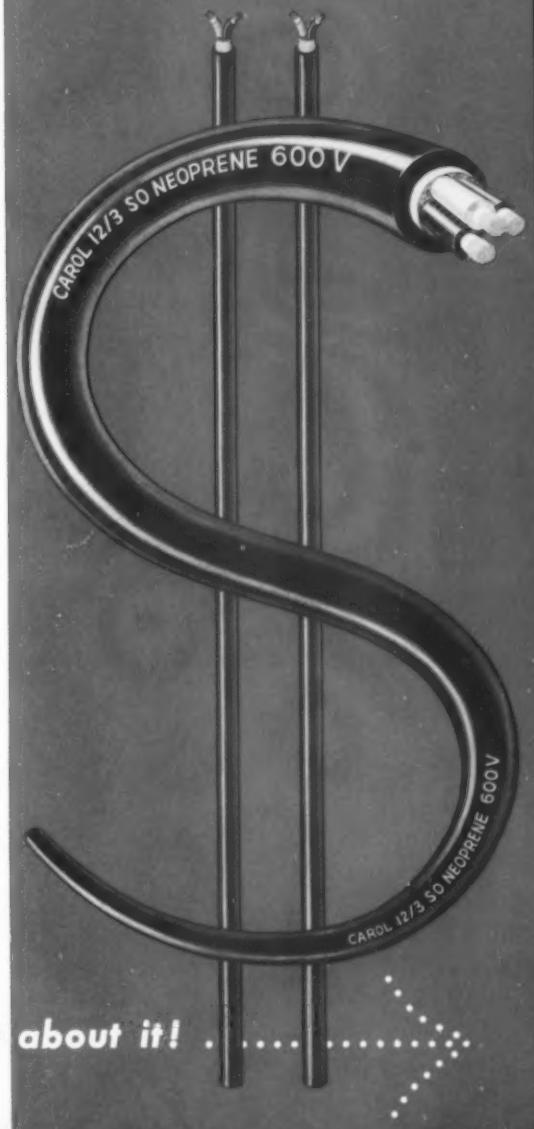

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Understanding the Code

By Walter R. Stone

This article should be especially helpful to the following readers:

- Electrical Contractors
- Electric Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ HAVING DISCUSSED important Code changes in the last several issues of ELECTRICAL SOUTH, we return now to our systematic study of the Code provisions.

Non-metallic sheathed cable is a poor man's luxury wiring method. Although this may sound paradoxical, it is true. For by the use of this type cable, a multitute of outlets and electrical connections can be installed in an abundance greater than that which is usually thought of as being adequate at a cost well below that of the same installation if made by most other wiring methods.

Contractors have been quick to take advantage of this low cost feature in order to provide a good all around wiring installation which will meet the owner's needs rather than install a skimpy amount of wiring by other more expensive means only to have it extended afterward by the owner by means of hazardous extension cords.

It was this feature which endeared it to many inspection authorities and may have been a contributing factor in prompting Code making authorities to extend the Code provisions to include more realistic and adequate minimum requirements in some occupancies. In any case, no one can deny that contractors are daily installing outlets in run-of-the-mill dwellings in such profusion as was unheard of before the advent of Type NM cable.

Applications of NM and NMC

The use of this wiring method is strictly limited, however, by the Code. The use of Type NMC, which is a relatively new type of non-metallic sheathed cable, is not nearly so restricted as that of Type NM. Whereas Type NM is restricted to dry locations only, Type NMC may be used in dry, wet, and corrosive locations.

Type NMC is especially suitable for barns where corrosive fumes are present. In dairy barns and similar barnyard areas, it stands up well long after metal armors and some raceways become rusty and deteriorated.

Type NM is used principally in dwellings and in small commercial establishments. In large commercial buildings and in some expensive dwellings where the cost factor is less critical, raceways are frequently used so that any future defective or overloaded conductors which may develop can be replaced easily with conductors of increased carrying capacity without the necessity of disturbing the building structures and finishes.

Type NM cable is not permitted to be embedded in any type

Code test questions

1. Type NMC non-metallic sheathed cable may be installed in corrosive locations. True or false?

2. Switch and receptacle outlets of insulating material may be used without boxes with exposed Type NM cable wiring and for rewiring existing buildings where Type NM cable is fished in. True or false?

3. Service entrance cable with an uninsulated neutral and an outer covering may be used as a feeder for an a-c 120/240 volt load center panel provided that the panel is within the same building as the service panel from which it receives its supply. True or false?

4. Underground feeder and branch circuit cable Type UF may be used as an interior wiring method. True or false?

5. Non-metallic surface extensions may be used in unfinished basements of dwellings. True or false?

6. Non-metallic surface extensions may be used in a building which is occupied as:
(a) an office.
(b) a dry goods store.
(c) a textile mill.
Which is correct? a? b? or c?

7. Non-metallic surface extensions shall be secured in place by approved means at intervals not exceeding a maximum of:
(a) 4½ feet.
(b) 18 inches.
(c) 8 inches except that the first fastening may be 12 inches from the supply connection if connected by means of an attachment plug.
Which is correct? a? b? or c?

8. Non-metallic surface extensions may be connected to an existing outlet and:
(a) run for a distance not exceeding 10 feet.
(b) one or more extensions may run in any direction except on the floor or within 2 inches of the floor.
(c) run to not more than one additional outlet.
Which is correct? a? b? or c?

9. An underplaster extension may be used:
(a) in a building of any type construction.
(b) only in a building of fire-resistive construction.
(c) only in a building having an automatic sprinkler system.
Which is correct? a? b? or c?

10. For an underplaster extension:
(a) where alternating current is used, all of the conductors of a circuit need not be contained in a single metal raceway.
(b) thin wall electrical metallic tubing shall not be used.
(c) heavy wall rigid metal conduit shall not be used.
Which is correct? a? b? or c?

Correct answers will be found at end of article on page 122.

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of masonry, plaster, or other fills; nor can it be run in shallow masonry chases and covered with plaster or similar finishes. When Type NMC is run in chases within 2 inches of the finish, it must be protected by a corrosion-resistant steel plate not less than 1/16 inch in thickness and ¾ inch in width.

Both types are prohibited for use as: "(1) Service entrance cable, (2) in commercial garages, (3) in theatres except as provided in 520-4, (4) in motion picture studios, (5) in storage battery rooms, (6) in hoistways, (7) in any hazardous location, (8) embedded in poured cement, concrete or aggregate."

The reference to Section 520-4 permits this wiring method in theaters and similar places of public assembly in which the capacity is less than 200 persons.

Some NM cable problems

The Code requirements which seem to cause the most confusion about the use of non-metallic sheathed cable are those governing its use (1) in air voids in masonry blocks, (2) where mechanical protection is needed and how this should be provided when needed, (3) where it may be run across joists instead of through bored holes in attics and basements, and (4) whether devices of insulating material, such as receptacle outlets, may be used without boxes.

Section 336-3 (a) states that Type NM cable ". . . may be installed or fished in air voids in masonry blocks or tile walls where such walls are not exposed or subject to excessive moisture or dampness." This is clear enough for inside walls, but the question always arises in connection with outside walls. How much moisture or dampness is to be considered excessive? The first sentence in Section 336-3(a) which precedes the sentence just quoted states, "This type of non-metallic sheathed cable may be installed for both exposed and concealed work in normally dry locations."

Most inspection authorities interpret the term "normally dry locations" in a manner which would include the hollow spaces in outside masonry walls, because, normally, they are dry even though an occasional abnormal condition exists which causes temporary dampness, such as a leak or sweating. This amount of dampness would not generally be excessive for cable with suitable insulation, such as Type TW. Type NMC is approved for this purpose whether the wall is wet or dry by the provisions of Section 336-3(b).

Degree of protection required

The requirements for providing protection against physical damage is not and can not be spelled out in so many words, since, if it were, an unusual condition could arise which had a need for mechanical protection but which would have no specific provisions to cover it. Therefore this Code provision is general in nature and perhaps somewhat vague in that it simply states in Section 336-6(b), "It shall be protected from physical damage where necessary, by conduit, pipe, guard strips or other means."

It is the term "where necessary" which is sometimes bandied around. But there is a redeeming feature. The type of protection intended is stated, and the general conditions needing such protection are listed. Therefore arguments, although quite frequent, usually arise between those whose opinions lean toward the extreme one way or the other.

For instance, there are those on the one hand who run cable loosely and at random without regard to the resulting clothes-line effect. On the other hand, there are those who think that regardless of where a cable is run, if it is exposed it must be in pipe.

Section 336-3 states that such cable may be run ". . . for both exposed and concealed work." Section 336-6(a) states, "The cable shall closely follow the surface of the building finish or of running boards. . ." when run exposed. Section 336-5 states that when run exposed the cable ". . . shall be secured in place at intervals not exceeding 4½ feet and within 12 inches from every cabinet, box or fitting. . ." Section 336-6(b) states, ". . . where passing through a floor the cable shall be enclosed in rigid metal conduit or metal pipe extending at least 6 inches above the floor."

Logical conclusions

Any exposed cable, therefore, which could reasonably be expected to receive abuse equal to that which would be received by exposed cable installed within 6 inches of the floor should be similarly protected by similar enclosures.

And by the same token, any exposed cable properly secured to surfaces need not be further protected unless it may be reasonably expected to receive abuse greater than it would receive when exposed on a normal surface, such as a ceiling.

Cable mounted on a wall in a dwelling, for instance, is subject to blows from furniture movements unless it is securely fastened to a surface which is protected by a door facing or window facing. Even then it could be damaged by children and should have at least a guard rail extending well up above a child's reach.

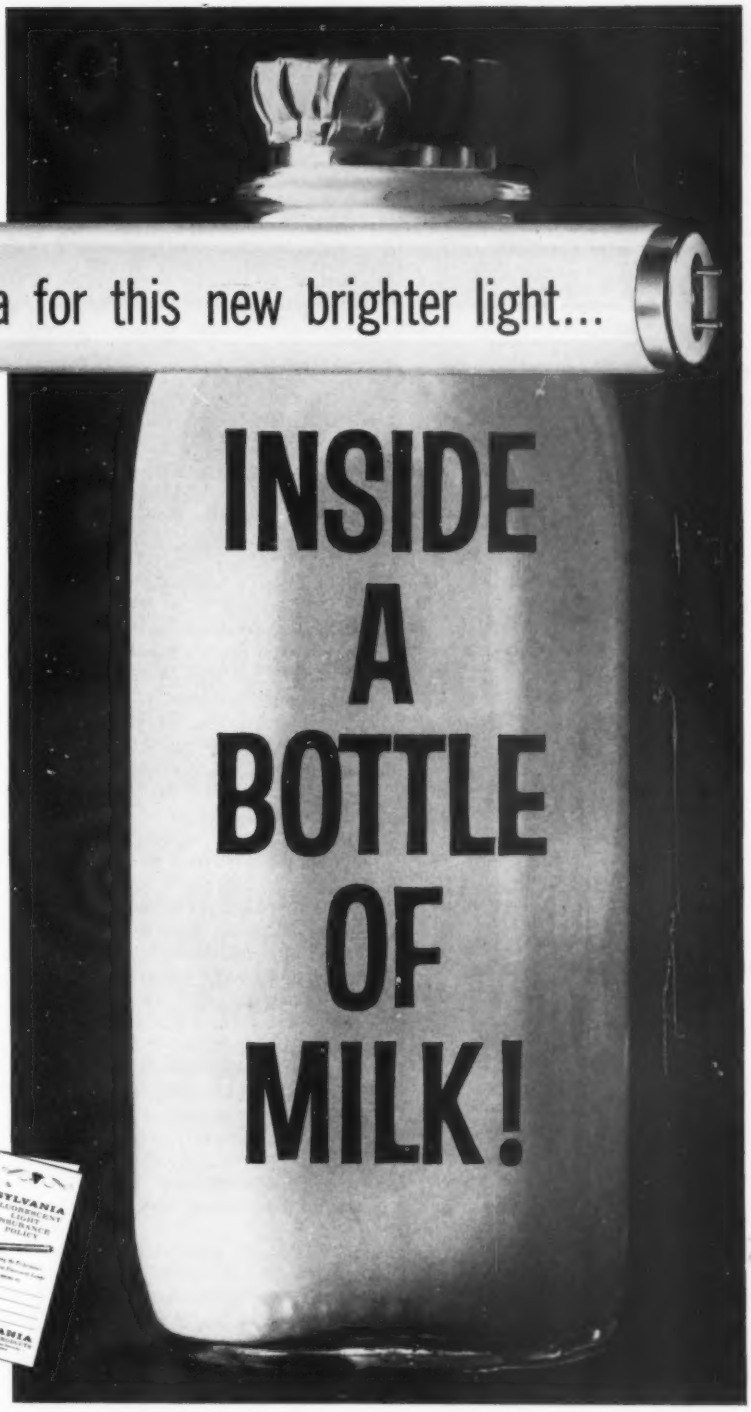
In unfinished basements, cables are required by Section 336-8 to be protected by running boards or be run through bored holes unless it is 3-conductor No. 8 or 2-conductor No. 6 or larger. (The larger sizes are less likely to be broken.)

In attics which are not accessible by means of permanent stairs or permanent ladders, cable is required by Section 336-9 to be protected either by running boards or by running it through bored holes within 6 feet of the edges of the scuttle hole.

In attics which are accessible by such permanent ladders or stairs, the same protection is required but the extent of the area is less definite. Cable run on rafters and studs requires the protection up to a point 7 feet above the floor or joists. Cable run on the joists themselves should be protected outward beyond the point where flooring or storage would be likely to extend. Any holes needed for cable should be bored through the approximate center of structural members to avoid undue weakening of the timbers.

Section 336-11 permits switches, receptacle outlets, and splicing devices which are factory enclosed in insulating material to be connected to non-metallic sheathed cable without the use of boxes for (1) exposed cable wiring and (2) rewiring existing buildings where the cable is concealed and fished. Only UL listed devices should be used. These must be of the type where connections are made to terminals within the insulating material. Such devices having "pig-tails" for splicing outside of the device are not acceptable for use without boxes.

Non-metallic boxes as well as metal ones are permitted by Section 336-12 to be used with non-metallic sheathed cable. Fixtures which are required to be grounded are sometimes more difficult to



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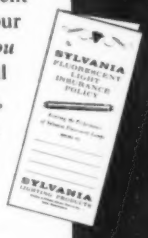

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ground with non-metallic boxes, however, than with metal boxes.

Non-metallic sheathed cable is occasionally installed erroneously for service entrance conductors for off-peak water heater loads and for temporary construction services. Such installations are not permitted by the Code regardless of whether it is Type NM or NMC.

Service entrance cable

Service entrance cable as defined in Article 338 has three Code recognized types. Type ASE has a protective armor and is less frequently used than other types. Type SE, sometimes referred to, also, as "range cable," has no armor. When mechanical protection is required, it is usually covered by a pipe sleeve or by a channel type guard. Type USE is approved for direct burial in the earth. It, too, requires protection against physical damage in some locations. This protection is usually provided by a raceway at each end where the conductors emerge from the earth and extend up a pole at one end and enter a building at the other end.

Such protective raceways should have a 90 degree bend where they go down into the trench in the earth and this bend should terminate with an insulating bushing. The raceway should extend up the pole a distance of not less than 8 feet, and if it is a utility company pole, it should be terminated at or above 8 feet at a point specified by the utility company that owns the pole.

At the building end, the raceway must extend to and be connected to the service equipment enclosure unless the service equipment is installed on a switchboard in which case the raceway may terminate with a bushing. Such raceways at both ends of the run must be properly grounded.

Mechanical protection for USE cable between the sections of raceway is usually provided by covering it with 2 inches of clean sand which is then covered with treated planks. The cable should be not less than 18 inches below finished grade. When run beneath driveways, the cable should be installed in conduit.

Interior use recognized

When used for interior wiring, service entrance cable may be used in the same manner as other cables if the grounded conductor has an insulation equal to that of the ungrounded conductors. It may also be used in a similar manner with an uninsulated conductor provided that the uninsulated conductor is used only as an equipment grounding conductor and not as a circuit conductor. (A grounded neutral is a circuit conductor.)

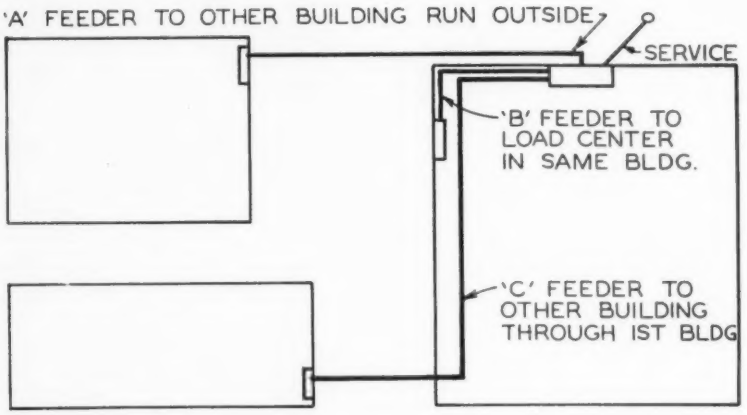
'A' FEEDER TO OTHER BUILDING RUN OUTSIDE
SERVICE
'B' FEEDER TO LOAD CENTER IN SAME BLDG.
'C' FEEDER TO OTHER BUILDING THROUGH IST BLDG

Fig. 1—Service entrance cable with uninsulated neutral may be used as a feeder to supply another building whether run outside as at "A" or through the building as at "C". However, such cable must have an insulated neutral if used to serve a panel in same building as at "B".

Where the grounded conductor is not insulated and this uninsulated conductor is to be used as a grounded neutral, then service entrance cable may be used for interior wiring only for the following purposes and under the following conditions:

It must have a non-metallic outer covering and be supplied by an a-c system not exceeding 150 volts to ground. It can be used only for (1) feeders from a service cabinet to other buildings or as service entrance conductors for such other buildings, and (2) branch circuits for ranges, counter-mounted cooking units, wall-mounted ovens, and clothes dryers.

Although a service entrance cable with an uninsulated neutral cannot be used as a feeder from the service equipment to a load center panel within the same building, it can be used as the feeder from the service equipment to supply another building. This permissive use as a feeder to another building is unfortunate in the opinion of a great many inspectors, because it is sometimes necessary in order to serve another building for the cable to run through a considerable portion of the building interior in order to reach a point where the second building can be served.

Also, this makes it very difficult for an inspector or a contractor to explain to an owner why he cannot be allowed to use such a cable for feeding another panel in the same building in which the service is located. This is especially true if the feeder to the second building happens to run right past the panel which he is not permitted to supply in the first building. (See Figure 1.)

It may have been the intent, originally, to permit cables with uninsulated neutrals as feeders to other buildings only when this could be done by running outside of all of the buildings concerned. However, that is not what is stated by Section 338-3(b). In any case, there are a great many inspectors who frown upon the use of uninsulated current-carrying conductors for interior wiring purposes. And a neutral is a current-carrying conductor. Especially when used as a feeder, depending upon the amount of load unbalance, such a neutral may carry considerable current from time to time. However, until (and unless) this section is revised, service entrance cable with an uninsulated neutral may be used as a feeder for this purpose.

Cables that may be buried

Underground feeders and branch circuit cable Type UF is similar in appearance to Type NMC nonmetallic sheathed cable and it may be used for the same purposes. In addition, like Type USE service entrance cable, Type UF cable may be buried directly in the earth. It also requires protection against physical damage when so

Note how ordinary EMT split early in pressure test while induction welded CIRTUBE EMT (shown here unplated) held fast, surpassing UL requirements.

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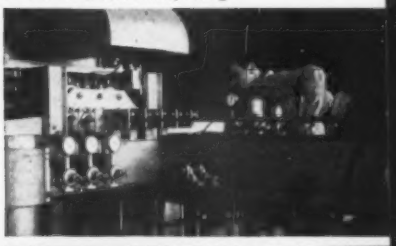

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buried similar to that provided for Type USE service entrance cable.

But unlike Type USE, Type UF cable is not permitted for use as service conductors and it must be provided with branch circuit or feeder short-circuit and overcurrent protective devices.

Some manufacturers have made cables which are approved as both Type UF and as Type NMC. Such cables carry both markings. Other cables are approved and marked as only one or the other. Cables which are not approved as Type UF (or Type USE) cannot be buried directly in the earth. Types UF

(Continued on page 122)

Questions on the Code

(Readers are invited to send in questions which they would like to see discussed in this department.)

Calculating gutter cross section area

QUESTION: It is a little confusing to me just how Tables 374-9(d) and 373-6(a) are to be used. Since Paragraph 374-9(e) refers to Table 373-6(a) which has smaller dimensions than those listed in Table 374-9(d) what is the reason for this reference?

ANSWER: Table 373-6(a) concerns wiring space which is required to be provided under certain conditions for cabinets and cutout boxes. Table 374-9(d) concerns auxiliary gutter wiring space, but it does not list size requirements. Instead, it lists minimum thickness requirements for the sheet metal used for the various sizes needed.

The size requirements needed for this purpose are determined by the rules of Section 374-5 and 374-8 provided that there are no bends in either the gutter or the enclosed conductors greater than 30 degrees.

If either of these are deflected more than 30 degrees, then the size requirements must also conform with the minimum requirements of Table 373-6(a). Hence the reference. Frequently, the sizes computed by either method will result in the same size gutter. At times, however, under other conditions, there is a difference.

As an example of how the tables and sections referred to above are used, assume the following conditions: An auxiliary gutter is to be installed to supplement the service equipment enclosures. From the CT can, 1 No. 350 MCM and 3 No. 500 MCM conductors are to enter the gutter and extend along its entire length. Also to be connected to the gutter by means of nipples are 4 No. 2 conductors supplying a 100 ampere switch; 3 No. 4 conductors supplying a 25 hp rated switch; and 4 No. 3/0 conductors supplying a 200 ampere switch. All conductors are to be Type RHW. What is the minimum size auxiliary gutter which would be permitted for these 15 conductors?

By the provisions of Section 374-5, all of the contained conductors shall not occupy more than 20 per cent of the gutter's cross sectional area. Such conductors, including all splices, taps, and insulated connections, shall not occupy more than 75 per cent of the gutter by the further provisions of Section 374-8(a).

Since the cross sectional areas of such taps and splices are extremely difficult to compute, most electricians use only the 20 per cent factor for conductor areas and attempt, by careful splicing and taping techniques, to stay within the 75 per cent maximum for insulated joints.

Inspectors use the same technique in checking the installation. That is, they compute the size by the 20 per cent factor and roughly estimate the 75 per cent factor.

Table 5 in Chapter 9 lists the following areas in square inches for the following conductor sizes: (The area of each size is then multiplied by the number of conductors of that size used to obtain total areas in each wire size. These totals are then added to get the total area of all conductors).

500 MCM—.9834 sq. in. times 3 conductors equals 2.9502 sq. in.

350 MCM—.7620 sq. in. times 1 conductor equals 0.7620 sq. in.

No. 2—.2067 sq. in. times 4 conductors equals 0.8268 sq. in.

No. 4—.1605 sq. in. times 3 conductors equals 0.4815 sq. in.

No. 3/0—.4151 sq. in. times 4 conductors equals 1.6604 sq. in.

Total area of all conductors to be used, 6.6809 sq. in.

Since the gutter size is the unknown factor and the wire size cannot exceed 20 per cent of this unknown, we can compute the required minimum size by the following formula: .20 X equals 6.6809. Therefore X equals 6.6809 divided by .20 which equals 33.4 square inches. But to allow a small amount extra for cumbersome splicing, a 6 inch by 6 inch gutter is selected which is 36 square inches or slightly larger than the required minimum.

For this size gutter, Table 374-9(d) requires No. 16 gauge metal. If, however, these conductors or the gutter is to be deflected more than 30 degrees, the gutter dimensions must also comply with the minimum width listed in Table 373-6(a).

Section 373-6 does not require extra width for conductors smaller than No. 1. Hence, the No. 2

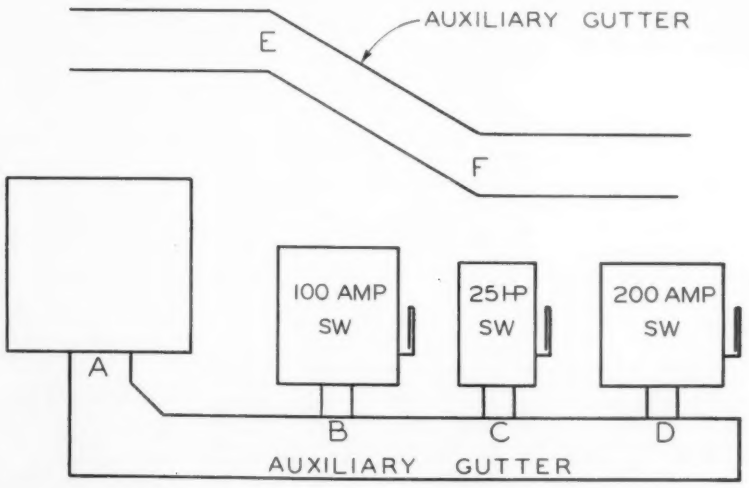

Fig. 2—Auxiliary gutters are basically required to be of such cross section that all contained conductors will not exceed 20 per cent of this area. However, additional rules apply where the conductors are deflected, such as shown at points A, B, C, and D; and where gutter is deflected, as shown at points E and F. See text for additional details.

G-E RMS-3A unit controls twenty-five remote 120V, 240V, or 277V circuits through inexpensive relay circuits of lightweight low-voltage wire.

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It's a motorized master switch, that turns 25 remote circuits ON and OFF, quickly, from one or more locations. Building superintendents or other personnel just push one button that actuates the control, to turn all the circuits ON or OFF.

You save money installing the RMS-3A, because it eliminates long, high-voltage switch loops between distant circuits and master-control locations. 24-volt G-E Remote-Control switching circuits and relays are used, instead — so that all connections to the control can be made with inexpensive, lightweight wire.

See your General Electric distributor for new wiring devices that give you the edge over competition! General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

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GENERAL ELECTRIC

and the No. 4 conductors can be ignored or rather treated as though they were not to be deflected.

Of the remaining conductors, there are 4 No. 3/0 wires which, by Table 373-6(a), require a minimum width of 4 inches. This is smaller than the 6 inch width required by the 20 per cent rule.

There is next a 350 MCM conductor which requires a minimum width of 5 inches. This is also smaller.

Finally, there are three No. 500 MCM conductors. This size requires a minimum width of six inches which, in this case, does not exceed the size previously selected. (Actually, it does exceed, slightly, the minimum size required for a straight run which, it may be remembered, was 33.4 square inches, not the 36 square inches selected. But for all practical purposes, the difference is negligible.)

Suppose, however, that instead of this group of various size wires, only 3 No. 500 MCM conductors were to be run in a gutter. Then there would be an appreciable difference in size requirements. For a straight run, three wires of this size with a total area of 2.9502 square inches would require a gutter having 14.75 square inches. A 4 inch by 4 inch gutter with 16 square inches could be used. But if deflected more than 30 degrees, a gutter 6 inches in width would be required. In both cases, No. 16 guage metal is the minimum thickness permitted. (See Figure 2.)

Practical grounding for service mast

QUESTION: Where a mast is used to extend the service above the roof but does not extend to the service switch, and Type SE cable is used for service conductors, does this mast have to be grounded? If it does, how can it be grounded in a practical way?

ANSWER: Section 250-33 states, "Metal enclosures for conductors shall be grounded, except in runs of less than 25 feet which are free from probable contact with ground, grounded metal, metal lath or conductive thermal insulation and which, if within reach from grounded surfaces, are guarded against contact by persons." This section was written before the popularity of ranch style houses which made masts so plentiful, and it has not yet been revised. As it is written, however, it covers an important point even though the point is not spelled out in so many words.

The joker, of course, is the bare neutral drop which is easily within reach of the metal mast. If a hot wire became grounded to the mast and someone touched the mast with his hand and the bare neutral with his head, he would have a head start to Heaven or wherever else he might be headed. Although I have not personally known of any disasters resulting from this, I have talked to other inspectors who have known of such instances. Certainly it is a possibility to anyone who is fixing a roof or cleaning a gutter.

Although not spelled out in section 250-33, the bare neutral is a "grounded surface" and it is "grounded metal." An inspector, therefore, is justified in requiring the mast to be grounded by this section alone. His general authority allows him to require it in any case if the condition, in his opinion, constitutes a hazard when not grounded. In my own opinion, the mast definitely should be grounded by reason of its proximity to the neutral even if there were no possibility of its coming into contact with metal-foil insulation or metal outlet boxes.

Section 250-56 states, "Isolated sections of metal raceway or cable armor, where required to be grounded, shall preferably be grounded by connecting to other grounded raceway or armor, but may be grounded in accordance with section 250-57."

Section 250-57 allows a grounding conductor run with the circuit conductors, a separate grounding conductor, and other means by special permission. Therefore, the best way to ground the mast is to extend it, by means of a reducer if necessary, all the way to the service enclosure.

The next best way is to install a grounding bushing on the lower end of the mast and run a grounding conductor with the circuit conductors to the service grounding bus.

A third way, by special permission, would be to bond the mast to the grounded neutral drop. This would require the permission of the utility company as well as the permission of the inspector. Or the utility company could secure the neutral drop to the mast by means of a metal bracket without a porcelain insulator. In this case, the inspector, of course, would have to *know* that the utility company would make this connection to ground for the electrician.

Fluorescent fixture frame grounding rules

QUESTION: Is it necessary to ground the metal frames of fluorescent fixtures which are mounted 9 feet above a wood floor if they are within reach of sprinkler system piping? They operate on 120-volt circuits.

ANSWER: Yes. Section 410-95 requires metal lighting fixtures of less than 150 volts to ground to be grounded if installed within 8 feet vertically or 5 feet horizontally of any grounded plumbing, metal work, or other grounded surfaces. (Although not a part of the question, I might add that fixtures of *over* 150 volts to ground are required by Section 410-94(a) to be grounded in any case.)

Mounting fixtures on cellulose ceilings

QUESTION: Can fixtures be mounted on low-density cellulose ceilings with a sheet of asbestos or gypsum wallboard (Sheetrock, etc.) between the cellulose and fixture instead of the 1½-inch air space?

ANSWER: No. Section 410-74 (b) requires that any fixture containing a ballast "be spaced not less than 1½ inches from the surface of the fiberboard" or be "approved for this condition."

At the time of this writing, no fixture has yet been listed as safe for mounting directly in contact with the surface of low-density cellulose fiberboard. The 1½-inch space is needed to prevent the transfer of heat from the ballast to the fiberboard. Neither asbestos nor gypsum wallboard will prevent such a transfer of heat except for short periods of time. Although neither of these products will conduct heat so rapidly as metal, both will, in time, become as hot as metal if enough heat is applied to them, just the same as a brick will. It just takes longer. Therefore, such substitutes are not acceptable in lieu of the required space.

Gypsum wallboard is also limited in the amount of heat it can withstand. But it can asborb and transfer from a defective ballast a sufficient amount of heat to exceed the safe operating temperature of low-density cellulose fiberboard).

New series of tables extended to include larger hourly rates

A NEW SERIES of estimating tables, completely revised in the light of more recent jobs and experience, are presented in this issue and will appear from month to month in forthcoming issues. These electrical estimating data sheets cover labor only and are arranged alphabetically with the basic material headings as a title for each tabulation.

Labor units given in these tabulations are based on a minimum of interference during work progress. The averages listed do not provide for abnormal job conditions, and any such abnormal conditions will require adjustments by the user, based on his experience.

The work units covered by each table are composed of one or more separate but closely related operations necessary for the complete installation of a particular basic item of electrical equipment. These operations associated with the basic material are described at the bottom of each table.

Most of the electrical estimating tabulations follow the same form. Column 1 at the left shows the size of the material to be installed. The second column from the left gives the time required to install the material, and it should be noted especially that this "productivity" column may be based on individual units or in the case of cable or conduit on units of 100 feet or 1,000 feet. The abbreviations "Ea." for each, "C" for hundreds, and "M" for thousands in Column 2 indicate the basis of the labor hours.

Columns 3 to 13, from the left, give the actual labor costs in dollars per unit of installation, at various hourly wage rates.

When calculations are being made for an hourly wage rate that doesn't correspond to any of the rates listed in Columns 3 to 13, the user may multiply the number of hours in Column 2 by 100 and this will give the labor cost based on an hourly wage rate of $1 per hour. By multiplying this by the hourly wage rate that actually applies in the user's locality, the exact labor cost of the operation may be obtained. Labor costs obtained in this way will be for units, hundreds of feet, etc., as given in heading of Column 2 of the table.

The labor units covered by the tables represent direct job labor costs and do not include delivery of material to site, engineering, estimating, or any other indirect cost.

As will be noted, some of the electrical estimating tabulations to be given will be for independent operations, such as excavating, backfilling, etc. These are included for use in preparing estimates on work of a special nature not covered under a specific table heading.

Tables will appear in alphabetical order.

CABLE NON-METALIC SHEATHED (BUILDING)
NEW WOOD RESIDENCES

NO. COND. SIZE	HOURS "C"	LABOR COST PER FT. INSTALLED AT FOLLOWING RATES										
		$2.00	$2.25	$2.50	$2.75	$3.00	$3.25	$3.50	$3.75	$4.00	$4.25	$4.50
2/14	4.2	.084	.095	.105	.116	.126	.137	.147	.158	.168	.179	.189
3/14	4.5	.09	.101	.113	.124	.135	.146	.158	.169	.18	.191	.203
4/14	4.8	.096	.108	.12	.132	.144	.156	.168	.18	.192	.204	.216
2/12	4.2	.084	.095	.105	.116	.126	.137	.147	.158	.168	.179	.189
3/12	4.7	.094	.106	.118	.129	.141	.153	.165	.176	.188	.20	.212
4/12	5.3	.106	.119	.133	.146	.159	.172	.186	.199	.212	.225	.239
2/10	4.5	.09	.101	.113	.124	.135	.146	.158	.169	.18	.191	.203
3/10	5.0	.10	.113	.125	.138	.15	.163	.175	.188	.20	.213	.225
4/10	5.4	.108	.122	.135	.149	.162	.176	.189	.203	.216	.23	.243
2/8	4.9	.098	.11	.123	.135	.147	.159	.172	.184	.196	.208	.22
3/8	5.4	.108	.122	.135	.149	.162	.176	.189	.203	.216	.23	.243
2/6	5.5	.11	.124	.138	.151	.165	.179	.193	.206	.22	.234	.248
3/6	6.0	.12	.135	.15	.165	.18	.195	.21	.225	.24	.255	.27
2/4	6.6	.132	.149	.165	.182	.198	.215	.231	.248	.264	.281	.297
3/4	7.2	.144	.162	.18	.198	.216	.234	.252	.27	.288	.306	.324

E-101-B

LABOR: INCLUDES PREPARATION, DRILLING, CUTTING, STRAPPING, AND CONNECTING TO BOXES (NO TAPE OR EXCAVATING)

3-60

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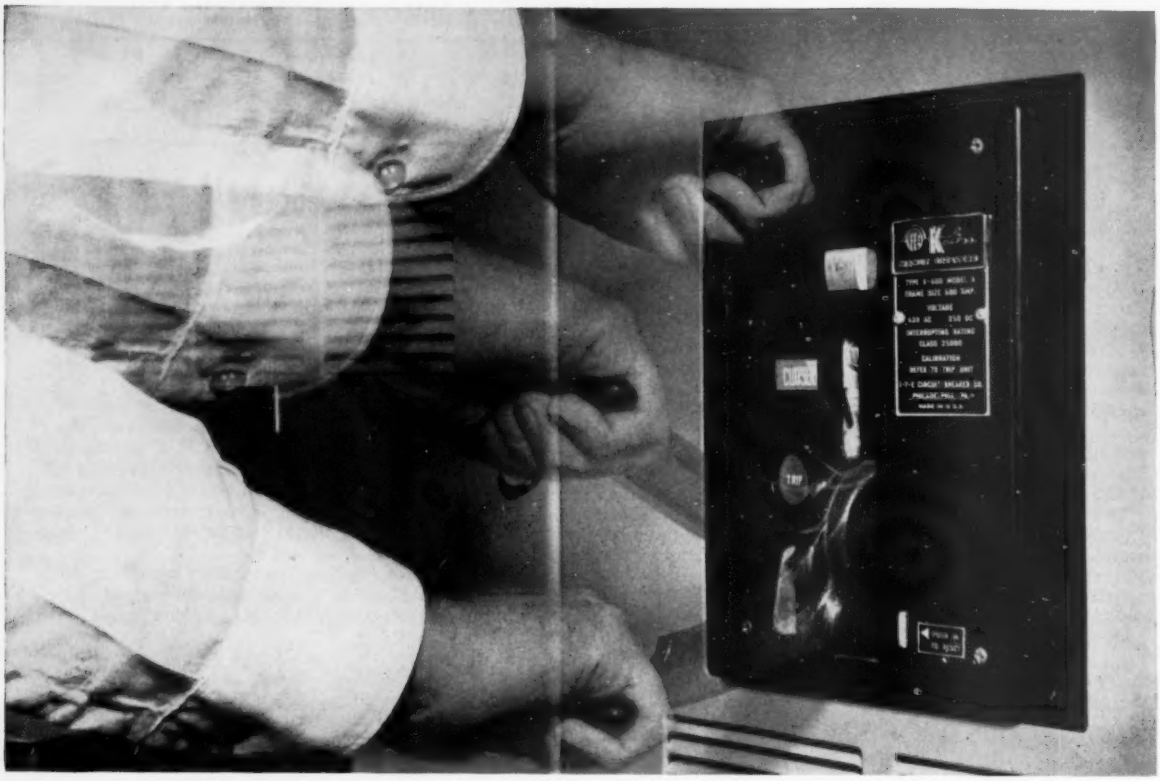
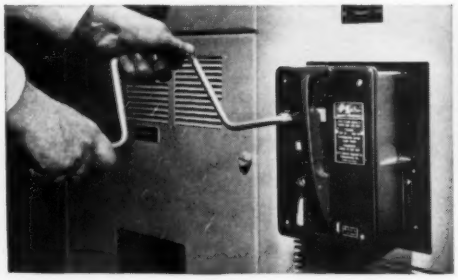


I-T-E started a revolution in 1957 when it introduced the completely new K-Line circuit breaker with stored energy closing. Today it is still the most advanced circuit breaker for low voltage switchgear you can buy.

ONLY I-T-E 600 V. SWITCHGEAR GOES BEYOND STORED ENERGY

GIVES YOU ADVANCES NO OTHER GEAR OFFERS



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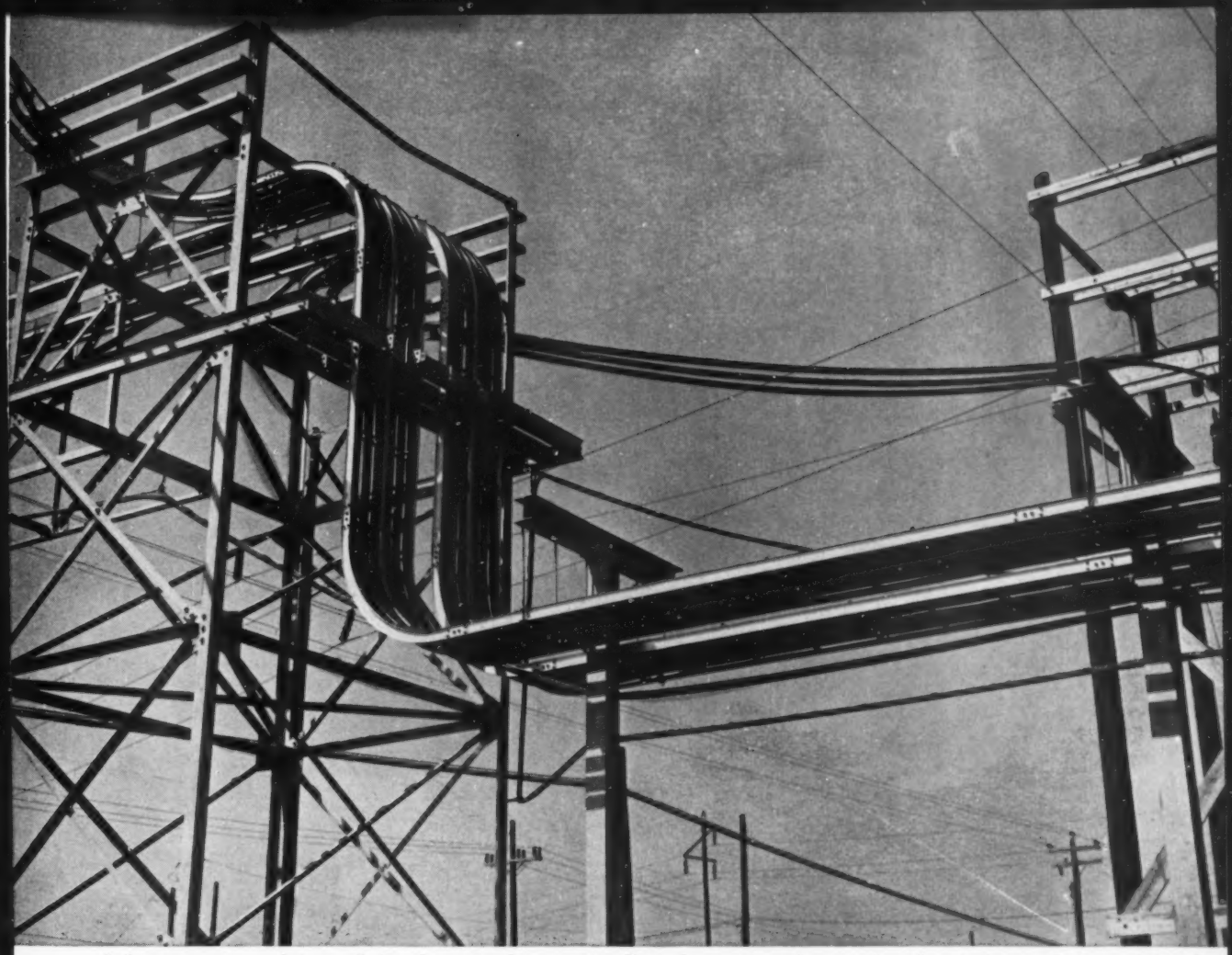

Indoors or out, rugged Anaconda Duralox means fast, easy installation because it needs no rigid conduit. And its tough Anaconda Butyl (AB) rubber insulation offers extra protection against ozone and moisture. Shown above is an interesting installation of Duralox with thermoplastic protective jacket over the interlocked armor.

PROBLEM: Installing high-voltage cable without rigid conduit

SOLUTION: Use Duralox, Anaconda Butyl (AB)-insulated interlocked-armored cable.

You save time . . . you save money . . . you save manpower —with Anaconda butyl-insulated Duralox.* *For Duralox has its own conduit of durable, yet flexible, metallic armor.*

This means fast and easy installation in long runs over and around obstructions, in trays, indoors or out—and all without the expense, trouble and time of laying rigid conduit and pulling cable through it.

Duralox will fit into your long-range plans as well—because it's 100% salvageable and can be readily moved as your plant layout changes.

Duralox's lower reactance—because of the close spacing of the conductors—results in reduced voltage drop and more efficient power distribution. Available in ratings of 5 kv, 15 kv, and higher, in addition to lower voltage ratings.

Whether your problem is wiring a new plant or rewiring an old one—see the Man from Anaconda. Duralox is just one of the many types of Anaconda wire and cable that can help you increase plant flexibility . . . reduce operating costs . . . bring in new power for your needs today and tomorrow. For full information on Anaconda Duralox Cable write for Bulletin DM-5606 to: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

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Duralox has Anaconda Butyl (AB) rubber insulation

for • extra-high resistance against ozone

• exceptional moisture resistance

• 22% more current-carrying capacity than 70° centigrade insulation

SEE THE MAN FROM

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FOR BUTYL-INSULATED DURALOX POWER CABLE

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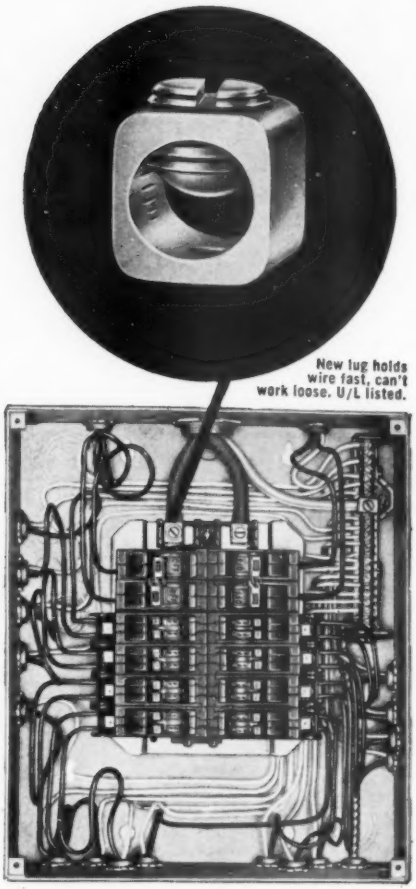
NEW! LUGS FOR BOTH COPPER AND ALUMINUM WIRE

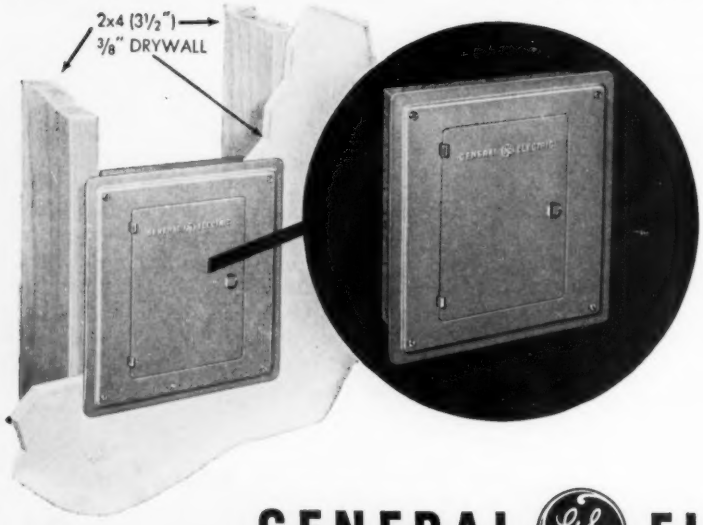


All General Electric load centers (100† and 200 amp.) and fuse pullers (100 amp.) are now U/L listed for both copper and aluminum wire—thanks to the new lug shown above which is standard on these devices *at no extra cost.*

Add this feature to the many advantages of G.E.'s new "twin" breakers and you'll see why more and more contractors are switching to General Electric for highest quality at the lowest cost. The "twin"* lets you put two quality breakers in the space you usually take for one, use a smaller load center, and realize big savings on every job.

† Except TRM Series • Trade-Mark

New G-E flush-front load centers fit flush even with 3/8" drywall



Here is a complete new line of flush-mounted General Electric "twin" load centers to answer your demands for equipment which fits flush with 2" x 4" studs and ⅜" drywall construction.

Ask your G-E distributor to show you the new *flush-front* load centers. Like all General Electric load centers, they feature Snap-Out interiors and provide automatic front alignment—even if the box is installed slightly off plumb.

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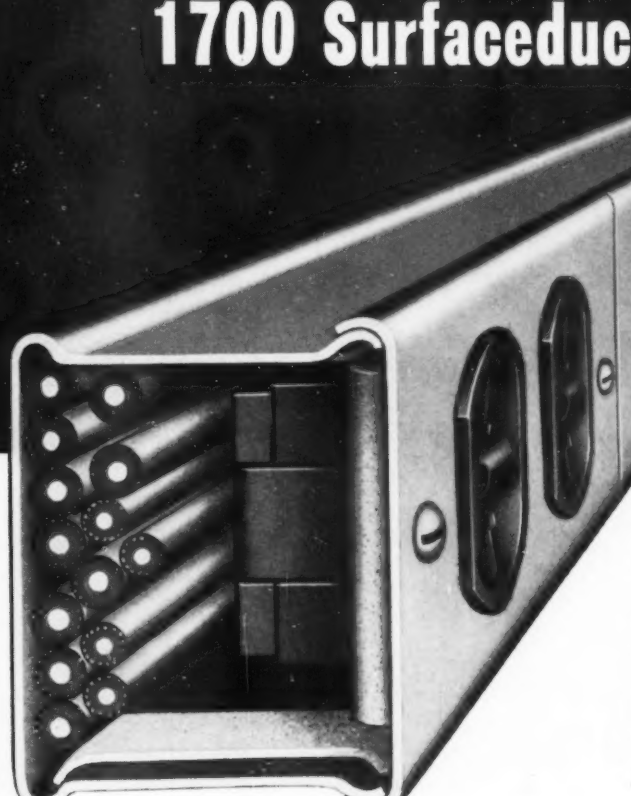

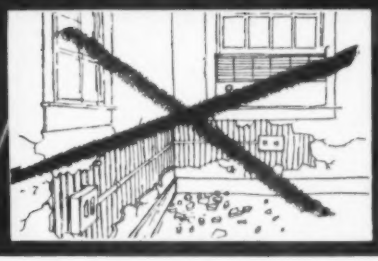

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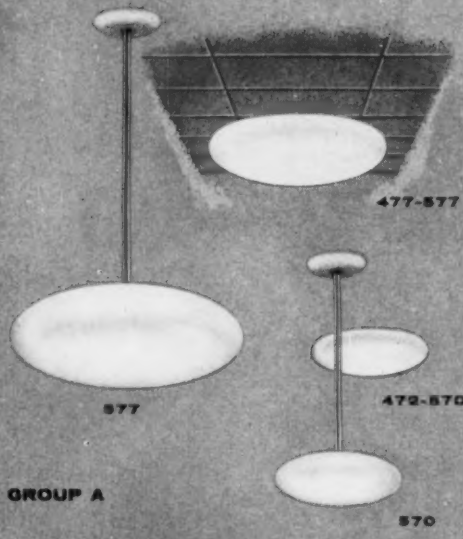
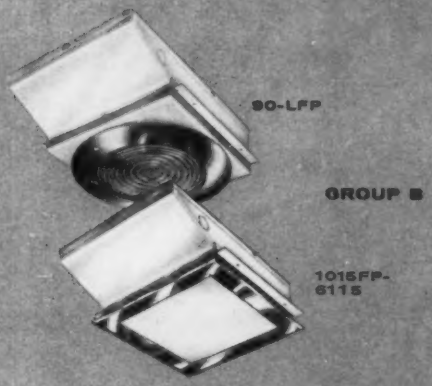
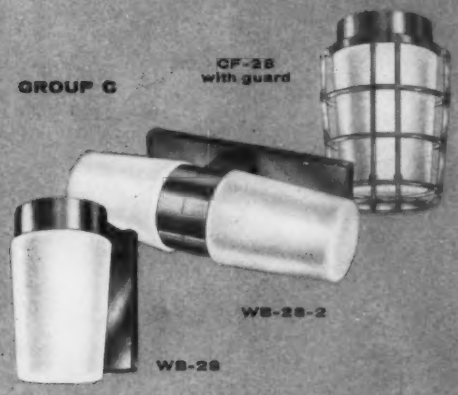
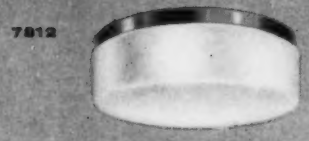
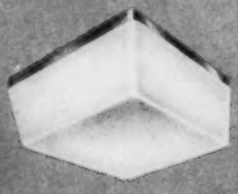








GROUP D



Group "C" The original weather proof, "Dielux" diecast aluminum bracket and ceiling lights now in 150-200 watt sizes. Hand blown "Thermopal" glass. Available with diecast aluminum guard.

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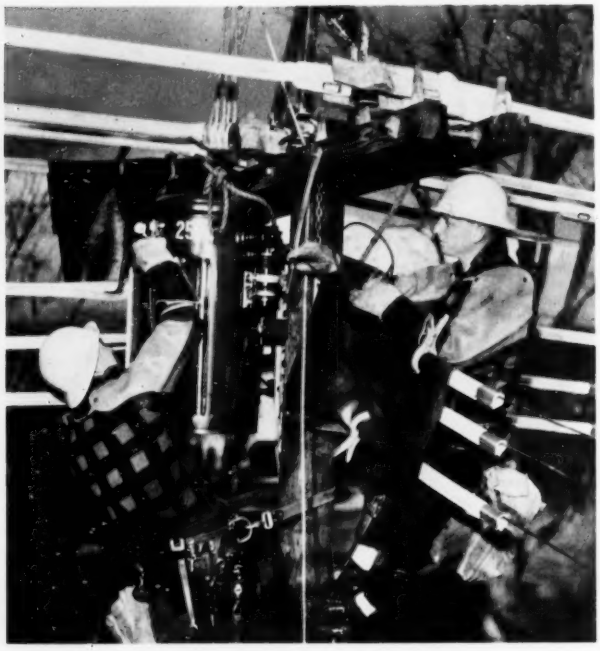

NEW GENERAL ELECTRIC TRANSFORMER with Permalex* insulation increases loadability by 20 percent—with no loss in operating life!

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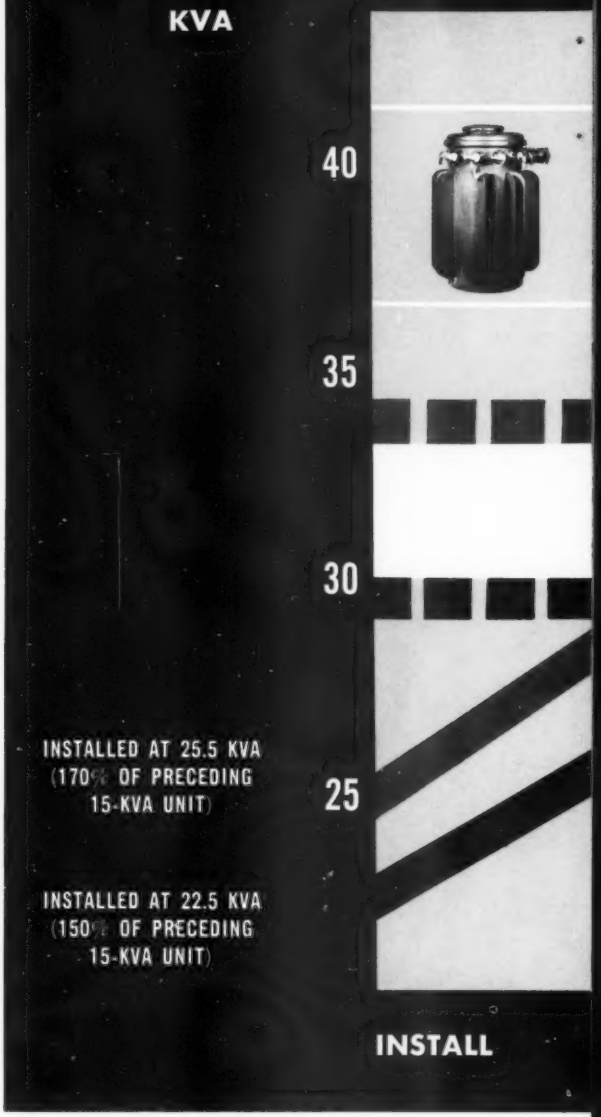
20% Higher Loadability Cuts Transformer Costs Per KVA Of Load Served



New Permalex insulation saves $1.17 per KVA with a 25 KVA transformer.

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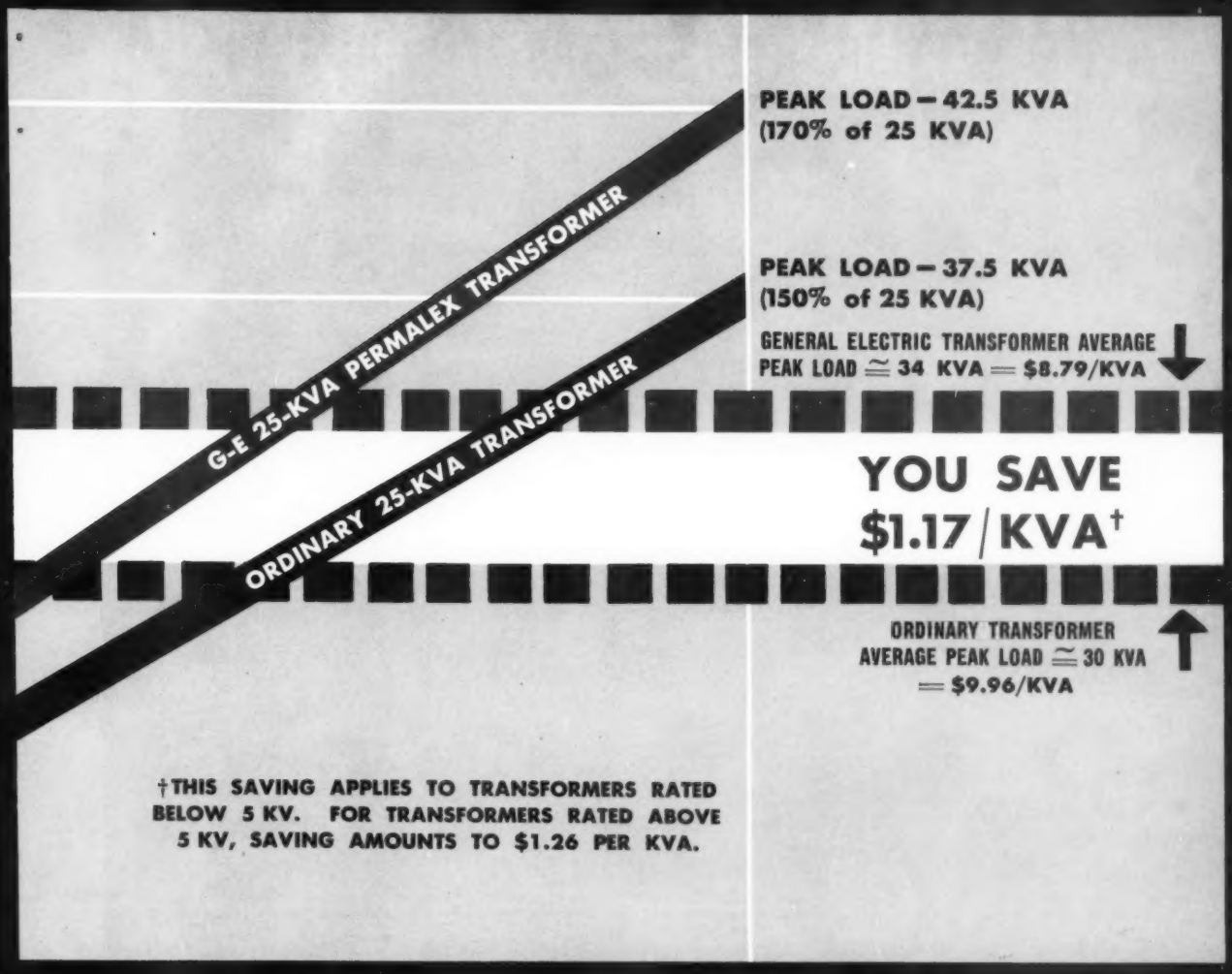
You get these savings with G-E 25-KVA Permalex transformers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YOU SAVE
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ORDINARY TRANSFORMER
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○ LOAD SERVED
CHANGE OUT

General Electric's new distribution transformers through 167 kva handle up to 20 percent greater overloads—with full operating life. This added loadability can reduce your transformer investment per kva of load served. Here's why:

On the average, transformers are changed out when peak load reaches 150 percent of rated load. With Permalex insulation in General Electric's new transformers, you can reach 170 percent of rated load before changing out.

As shown in the example above, a 15-kva transformer would normally be changed out when peak load reaches 22.5 kva. A 25-kva unit would then be installed and used until the load increased to 37.5 kva. The average peak load on this ordinary transformer would be 30 kva. Since the net price of a 25 kva, conventional, no tap, transformer below 5 kv is $299, the resultant cost is $9.96 per kva of load served.

With General Electric's 20 percent added loadability, a 15-kva transformer would be used until the peak load reaches *25.5 kva.* A 25-kva unit would then be installed and used until the load reached *42.5 kva,* or 170 percent of rated load. The average peak load of the G-E transformer would then be 34 kva. Again, since the price of the 25-kva transformer is $299, the resultant cost is $8.79 per kva —or a saving of *$1.17 per kva of average peak-load capacity over ordinary transformers.*

Are you taking advantage of this dollar-saving opportunity? For complete information on how you can make Permalex insulation pay off, contact your G-E Sales Engineer, or write for bulletin GEA-6070 to Sect. 431-89, General Electric Co., Schenectady, N. Y.

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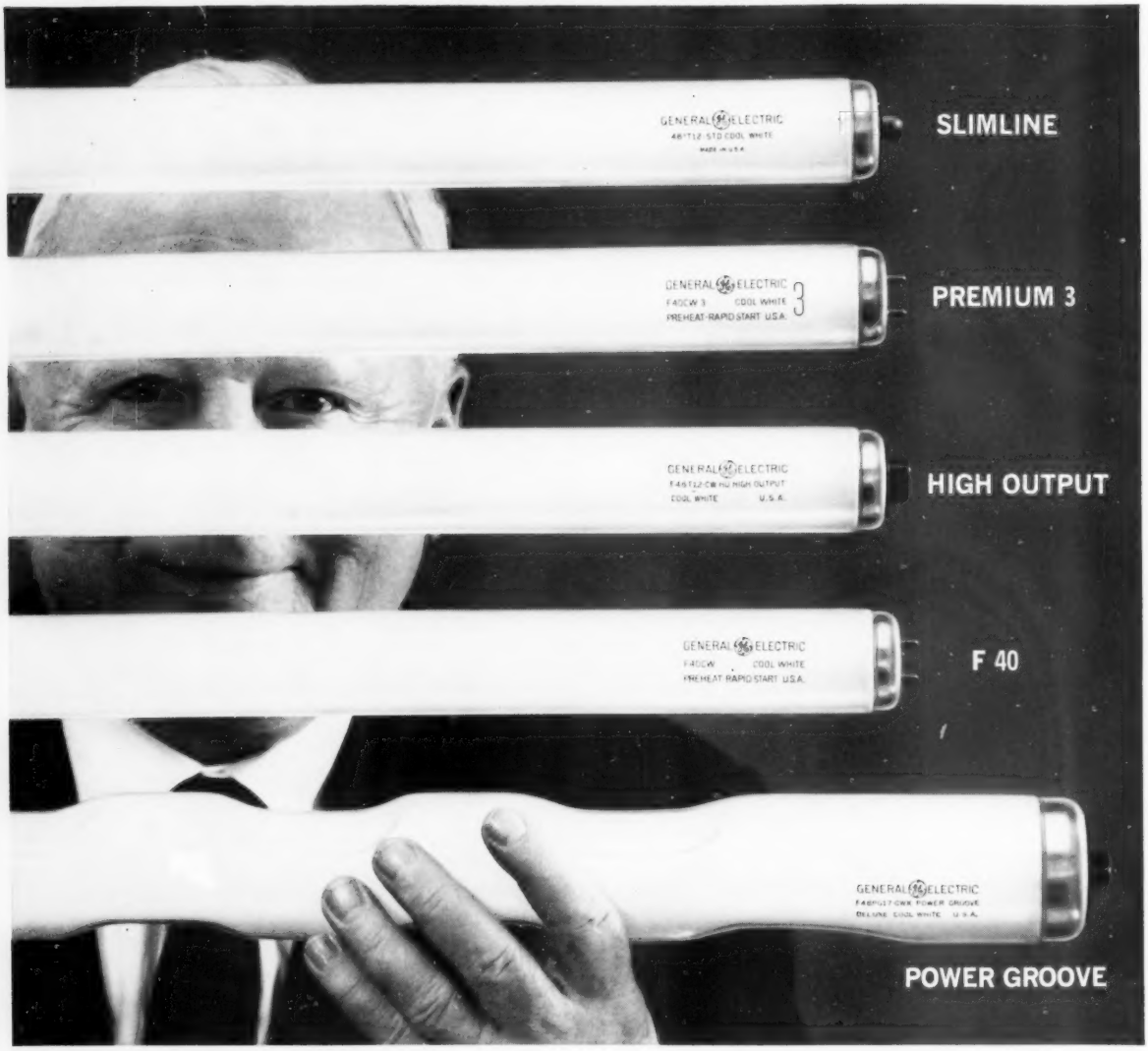
GENERAL ELECTRIC

General Electric Fluorescent Lamps SAVE YOUR CUSTOMERS MONEY



Take initial cost for example:

NEW G-E POWER GROOVE LAMPS CAN SAVE CUSTOMERS $15 TO $85 PER LAMP!

General Electric's Power Groove* Lamp is the most powerful, most popular high intensity fluorescent you can buy. Because it *delivers* more light, users can have brighter plants, offices, stores, even outdoor lighting *while using fewer lamps and fixtures.*

Thus they can save, on initial cost, $15 to $85 per lamp over previous fluorescent types, depending on the installation. It's all because of the grooves in the tube which bend the arc stream and lengthen it to create extra light.

G-E Power Groove Lamps are a product of the same General Electric Lamp research that has improved *every* G-E Fluorescent Lamp—whether it's the slimline, high output, or one of General Electric's two new 40-watt lamps.

WHICH G-E MONEY SAVER LAMP IS THE BEST BUY? There's one that will solve any lighting problem. And General Electric's published record of performance leadership is your assurance that, if they use G-E Lamps exclusively, your customers' lighting systems stay up-to-date automatically. For more information call your G-E Lamp supplier or write: General Electric Co., Large Lamp Dept. C-010, Nela Park, Cleveland 12, Ohio.

*General Electric trademark for its non-circular cross section fluorescent lamp

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General Electric . . . where bright ideas become better lamps

UTILITY ENGINEERING

Transmission — Distribution — Metering

Design
Installation

Testing
Maintenance

Another advantageous utility application of plastic conduit—see page 65

Labor unit data for outside electrical construction—page 62
Is "demand meter" properly named?—page 65
Light field test set for network protectors—page 66
Basic data on conductor heat dissipation—page 72
Aerial cable system features special components—page 76
Lightning protection on distribution circuits—page 80

Estimating labor unit data for

◆ To the limited field of literature on the subject of labor units for electrical installations, a comprehensive new book has recently been added. Compiled by John S. Page and Jim G. Nation, and published by Gulf Publishing Co., of Houston, Texas, this comprehensive work provides another authoritative source of data on electrical job labor units for electrical contractors, electric utility company personnel, industrial electricians, consulting engineers, and others concerned with electrical installation labor estimates.

Two features, particularly, contribute to the value of this book as an estimating tool: (1) It is comprehensive, covering practically every type of electrical materials and equipment that will be encountered on residential, commercial, and industrial electrical installations, including outside construction such as distribution lines, street lighting, and underground duct and cable construction, as well as special indoor systems such as communication and signal systems. (2) Each table of labor units contains adequate explanation as to the specific operations covered.

By special permission of the publishers, Electrical South is privileged to present, in a series of several articles, the labor unit data relating to outside construction, including underground duct and cable work.

Productivity factors

To make intelligent use of the labor unit data presented in these tables, the user must give consideration to a number of factors that may affect the production efficiency of his crews as compared to the production efficiency of the crews upon whose efforts the tables are based.

To help the user make these adjustments, the authors report that the tables are based upon a productivity efficiency of 70 per cent which they consider average. As a guide to the basis they used in arriving at this percentage, they classify productivity efficiency into five ranges as follows:

1. Very low	10-40%
2. Low	41-60%
3. Average	61-80%
4. Very good	81-90%
5. Excellent	91-100%

To arrive at the over-all productivity efficiency, the estimator must first arrive at estimates of six important job factors that will affect the production efficiency of the crews. These factors are: general economic conditions; project supervision; labor relations; job conditions; tool and equipment conditions; and weather conditions.

Using the scale indicated by the five numbered ranges given above, the estimator evaluates each of the six factors in percentage and obtains the average of these six percentages in order to determine the over-all productivity efficiency of his crews on the particular job under consideration.

Assume, as an example, that the estimator rates these six production factors as follows for a particular job: general economic condition, 75%; project supervision, 70%; labor relations, 65%; job conditions, 60%; equipment factor, 70%; and weather conditions, 50%. The average productivity efficiency would be $390 \div 6 = 65\%$.

Since the labor unit data in the tables are based on an average productivity efficiency of 70%, these values would have to be increased 5% above the tabulated values in order to be applicable to the job under consideration.

Evaluating the data

Instead of increasing each of the labor units by 5% and then multiplying by the hourly pay rate of the crew, it is much simpler to increase the hourly pay rate of the crew by 5% (that is, multiply it by 1.05) in order to obtain the adjusted rate and then this figure can be applied directly to the various labor units given in the tables in manhours per an operation.

For example, say the rates of pay in a given situation are as follows: general foreman, $4.025 per hr.; foreman, $3.775 per hr.; journeyman, $3.525 per hr.; and apprentice, $2.770 per hr. Assume that four identical crews are to be worked under one general foreman, each crew consisting of a foreman, nine journeymen, and one apprentice.

A day's work by this crew will include 2 hours of general foreman's pay @ $4.025 or $8.05; 8 hours of foreman's pay @ $3.775 or $30.20; 8 hours of pay for each of 9 journeymen @ $3.525 or $253.80; and 8 hours of apprentice pay @ $2.770 or $22.16. The total wages per crew per day is therefore $314.21.

Since neither the general foreman or the crew foremen work with tools, only 80 manhours of work per day is obtained from each crew (72 hours for journeymen, 8 hours for apprentice). The composite manhour rate then is $314.21 \div 80 = \$3.93$.

For the job under consideration, with the productivity efficiency rated at 65%, the manhour rate would be evaluated by multiplying $3.93 by 1.05 which equals $4.13.

Accordingly, for this particular job, with the crews described, the cost of performing any of the specific operations listed in the labor unit tables may be estimated by multiplying the manhours listed for the operation by the composite adjusted rate of $4.13 per manhour.

What the tables cover

The authors of these labor unit data point out specifically what has been taken into account in determining these values. The user should study the notes that accompany each table.

Also, it is to be noted especially that the tables presented in this and the several articles to follow include allowances for labor involved in storing, handling, hauling, installing and connecting the material or equipment involved, but do not cover the cost of the materials and equipment itself; nor do they include any allowance for overhead costs or profit.

In the case of the data for underground duct and cable, the manhours given do not include excavation. (A special section of the book covers data on demolition, excavation, and concrete.)

All data presented in this article copyrighted 1959 by John S. Page and Jim G. Nation.

outside electrical construction - 1

Overhead street lighting

Poles, standards and accessories

Net manhours each

Manhours include handling, hauling, setting, and aligning items as outlined above.

Manhours do not include excavation, foundations, or mast arms. See respective tables for these charges.

Size	Item	Manhours
	POLES	
30 feet	6"-5"-4" Tubular Steel	20.30
30 feet	7"-6"-5" Tubular Steel	23.15
35 feet	7"-6"-5" Tubular Steel	26.00
40 feet	7"-6"-5"-4" Tubular Steel	29.25
	STANDARDS	
20 feet	Steel	23.80
25 feet	Steel	26.25
30 feet	Steel	28.50
35 feet	Steel	34.05
40 feet	Steel	39.40
20 feet	Aluminum	22.25
25 feet	Aluminum	24.60
30 feet	Aluminum	25.20
35 feet	Aluminum	28.85
40 feet	Aluminum	33.15
20 feet	Concrete	25.50
25 feet	Concrete	27.80
30 feet	Concrete	30.00
35 feet	Concrete	37.45
40 feet	Concrete	43.15
	POLE ACCESSORIES	
	Pole Top Pins	1.50
	Pole Bands	3.00

Supports

Net manhours each

Manhours include handling, hauling, setting, and aligning including pole plates and tie rods or scrools.

Center span suspension manhours include 5/16-inch guy strand, guy clamps, strain insulators, and eye bolts.

Manhours do not include pole setting or luminaire installation. See respective tables for these charges.

Size	Item	Manhours
4 feet	Gooseneck Bracket	4.15
4 feet	Upsweep Bracket	4.15
6 feet	Upsweep Bracket	4.70
8 feet	Upsweep Bracket	5.20
4 feet	Straight Pipe Bracket	4.15
6 feet	Straight Pipe Bracket	4.70
8 feet	Straight Pipe Bracket	5.20
6 feet	Mast Arm	5.55
8 feet	Mast Arm	6.00
10 feet	Mast Arm	6.50
12 feet	Mast Arm	7.40
14 feet	Mast Arm	8.30
16 feet	Mast Arm	9.25
-	Center Span Suspension	10.80

Control installations

Net manhours each

Manhours include storing, handling, hauling, and installation of these items.

Control wiring manhours includes wiring from low voltage source to time switches, photoelectric cells and relays, and to controllers and consists of low voltage wire and cable, fuse blocks, switches, etc.

Item	Manhours
Contactors (Oil Switches)	7.80
Time Switches	3.15
Photoelectric Cell	3.15
Pilot Wire Relay	2.60
Control Wiring	4.55
TRANSFORMERS	
10 KVA Constant Current	11.15
15 KVA Constant Current	12.75
25 KVA Constant Current	15.10

Luminaires

Manhours include storing, handling, hauling, setting and aligning of wire or cable, fiber conduit and other material to connect luminaire to street lighting circuit.

Manhours do not include installation of wire or cable for lighting circuit. See respective tables for this charge.

Item	Manhours
Radial Wave Reflector	2.60
Suburban Open	2.60
Pendent Incandescent with Ell or Plumbizer	3.90
Side Mounted Incandescent with Slip Fitter	3.90
Incandescent with Built-in Control	5.20
Mercury Vapor Unit	3.90
Sodium Vapor Unit	5.20
Deflectors	.65

Pole setting

Net manhours each

Manhours are for all labor involved under average conditions for the items as outlined in the table, including hauling pole up to two miles.

If pole location is hard to get to and working area is limited, add for this operation.

Manhours do not include equipment usage.

Above manhours based on following typical crew—Pikes: foreman, truck driver, and six workers; Gin Pole: foreman, truck driver, and four workers; Boom or Crane: foreman, truck driver, and two workers.

Item	Erect with:		
	Pike	Gin Pole	Boom or Crane
25 feet Wood Pole	9.75	6.50	5.20
30 feet Wood Pole	11.44	7.54	6.24
35 feet Wood Pole	12.87	8.58	7.28
40 feet Wood Pole	14.56	9.49	8.19
45 feet Wood Pole	15.99	10.53	9.23
50 feet Wood Pole	17.42	11.44	10.27
55 feet Wood Pole	18.85	12.48	11.18
60 feet Wood Pole	20.28	13.52	12.22
65 feet Wood Pole	21.79	14.56	13.26
70 feet Wood Pole	23.14	15.47	14.17
75 feet Wood Pole	24.57	16.51	15.21
Roofing	-	-	.78
Gaining (on Ground)	-	-	.65
Cribbing — One 6' Log — 6 feet deep	-	-	3.25
Cribbing — Two 6' Log — 6 feet deep	-	-	7.80
Barrel	-	-	1.95

Guys

Net manhours each

Manhours include warehousing, handling, hauling, and placing guy strand, two three-bolt or other type guy clamp, two additional clamps per strain insulator (except wood strains), thru bolts and guy hooks.

Manhours are based on ground make-up as much as possible.

Manhours are based on typical crew consisting of foreman, truck driver, two linemen, and two groundmen.

Item	Manhours	
	5/16"	1/2"
HEAD OR STUB GUY		
No Strain Insulators	3.90	4.29
One Strain Insulators	5.20	5.85
Two Strain Insulators	6.50	7.15
ARM GUY		
No Strain Insulators	4.55	4.55
One Strain Insulators	5.85	6.50
Two Strain Insulators	7.15	7.80
DOWN GUY		
No Strain Insulators	3.25	3.90
One Strain Insulators	4.55	5.20
Two Strain Insulators	5.85	6.50
MISCELLANEOUS		
Add for Sidewalk Guy	1.95	
Add for Guy Protectors	.65	
Add for Strain Plates	.65	

Grounding

Net manhours each

Manhours include handling, hauling and complete installation of grounding items as outlined in the table.

Item	Manhours
Pole Butt Plates	.45
Pole Butt Coil	.75
Driven Ground Rod or Pipe	.75
Wire Attached to Pole 1 Connector	1.50
Wire Attached to Pole 2 Connectors	3.00
Wire Attached to Pole 3 Connectors	4.50
Attach Wood Molding	.75

Is electric "demand meter" properly named?

By Nick Newton
Division Meter Supt.
Arkansas Power and Light Co.
Harrison, Ark.

◆ "WHY is your meter called a demand meter, and who demands what of whom?"

This question was recently asked by one of our customers. If you work in the electric utility field, or, as I do, in the metering phase of this field, how would you have answered?

In our work we are asked many questions by our customers, but they generally run along the same lines and we soon learn to anticipate them, and have answers ready. This question, however, was not anticipated and no stock answer was ready.

Why *do* we call it a demand meter? We in this field of work assume that the name apparently derived from the fact that customers, especially commercial and industrial customers, require, or demand, if you please, a certain amount of readily available electric power, and the utility must supply the facilities and equipment necessary to furnish it. The term "demand" probably stems from this fact.

The customers then "demand," but how many of them see it in that light? How many, on the other hand, believe the monkey to be on the customer's back, and that the utility demands something of the customer. The answer is obvious, and paradoxical on its face; and something should be done about it.

Before the advent of demand meters, commercial and industrial customers were billed on connected load, usually expressed in horsepower, and kilowatthours. No method of compensation existed to offset the fact that the total connected load might never be on and running at the same time. Some of these customers seldom used one half of their equipment simultaneously. Today we would say that their "conversion factor" was less than fifty per cent.

This fact was not considered then, however, in billing. The utility had no way of knowing how much of the equipment had been used. This method of billing was haphazard and generally unfair to the customer, since, even though the utility was required to have the full amount available should the customer need it, the customer should have only been charged for the amount actually used.

Obviously some means of mediation in measurement was needed, and the utilities, with the cooperation of the manufacturers, eventually came up with what is now known as the demand meter. This meter measured only the electricity actually used, indicating or recording it in kilowatts; the indicating meters give a "peak" or maximum, and the recording meters give a peak plus an average over a specified period of time. Originally these meters measured only kilowatts, and were connected in series with the kilowatthour meter. The combination meters that register kilowatthours and kilowatts were introduced later. These meters provided an equitable means of measuring and billing, and the change was all in favor of the customer.

Few customers, however, greeted this new meter with enthusiasm fitting its purpose. They might have, however, had any foresight been used in naming it. But when an additional meter was tied in with their existing meter, and they were told, of all things, that it

(Continued on page 84)

Pole top application for plastic conduit

◆ PUBLIC UTILITY companies across the nation are discovering that semi-rigid plastic conduit is speeding wiring installations and repair jobs on telephone and electric utility poles.

An East Coast utility company is using up to 1,000 feet of the plastic tubing each month in preference to the traditional wood or rigid ceramic conduit because it is less expensive, easily installed, and durable.

The flexibility of the plastic conduit permits simple bends that are impossible with the ceramic-type conduit, and difficult with wood. The strength of the plastic tubing also allows replacement of two-inch diameter ceramic conduit with one-inch plastic conduit, making the installation less bulky. The lightweight plastic tubing, about one-seventh the weight of metal, is also more easily handled by linemen.

The plastic conduit is being used for runs from distribution transformers under cross arms and along poles to 120-volt feeder lines. It is also used for all wire components in the 120-volt circuits of street-lighting assemblies. The linemen work with standard lengths of conduit, cutting them on the job with hacksaws to fit their needs, or with pre-cut lengths. The conduit is fastened to poles and cross arms with staples.

The plastic conduit used by the East Coast company is made by Triangle Conduit and Cable Co. from Kralastic, an ABS polymer produced by the Naugatuck Chemical Division. United States Rubber Co.

Lineman fastens plastic conduit under crossarm with heavy staples. Some utility companies are using this material in place of wood or ceramic conduit because of its light weight, durability, and ease of handling.

Light field test set maintains

By W. L. Patterson
Underground Engineer
Alabama Power Company
Mobile, Alabama

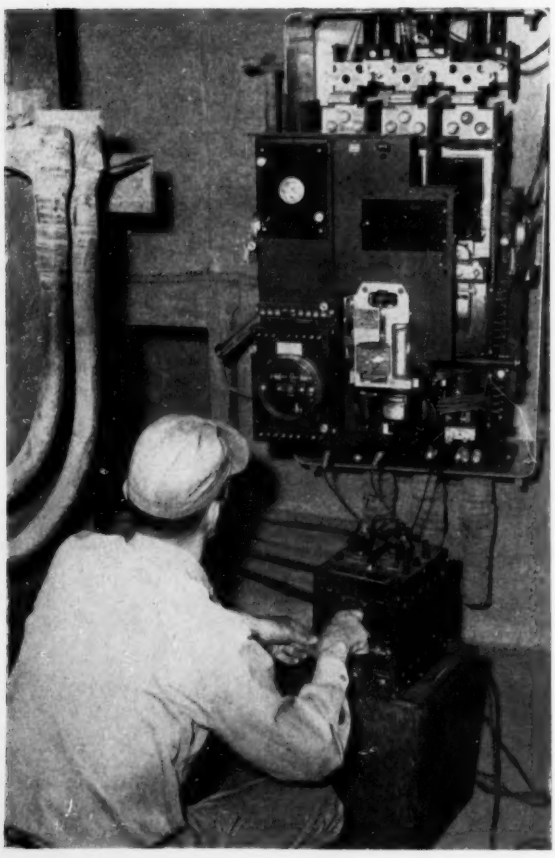
◆ No serious malfunctions or maintenance problems have developed on the underground network protectors operating in the downtown area of Mobile, and this is believed to be the result largely of the use of an efficient network protector field test set. This test unit has proved to be a reliable and economical means of preserving excellent operating conditions among the network protectors of all makes connected to the Mobile underground network system.

In early 1947, the Alabama Power Company's electrical distribution system in the downtown area was converted from a radial type to a network system. At that time, transformer banks on this network were in three sizes—namely 300, 450 and 600 kva.

Since all network protectors initially installed were purchased from one manufacturer, the initial test equipment involved was developed for service in testing the relays used in this particular make of protector in its 1,600 and 2,000 ampere sizes. It had the ability to produce extremely accurately results in the testing of both master and phasing relays and was capable of sizeable voltage and current vector variation through a considerable range of magnitude and phase angle.

However, there were drawbacks. The physical size and weight of the protector test set was quite formidable when viewed with an eye toward mobility and ease of handling. The 26″ x 32″ x 11″ piece of precision equipment weighed in at approximately 65 pounds.

The very fact that it was a precision instrument with delicate controls required the presence of somewhat highly trained personnel. The maze of wiring connections necessary for a test setup, together with the handicap of individual controls on voltage and



With one simple set up, the test equipment applies an exact low voltage across the network protector terminals to check the protector closing operation.

A slight change in the connections, and the test set loading elements draw reverse current through the network protector to test its trip operation.

network protector reliability

current vectors, considerably slowed the testing procedure. The set was designed to test only the relay operation and did not, through relay action, prove out the network protector, its current transformers, or other component parts.

The inadequacies of the original network protector test set were further pointed out when, in 1950, additional network protectors were purchased from another manufacturer. These protectors were designed for service with 500 and 750 kva three-phase units. It was discovered that because of a difference in design characteristics, the original test set would not perform satisfactorily with these new protectors. Consequently, the design of a new network protector field test set was begun.

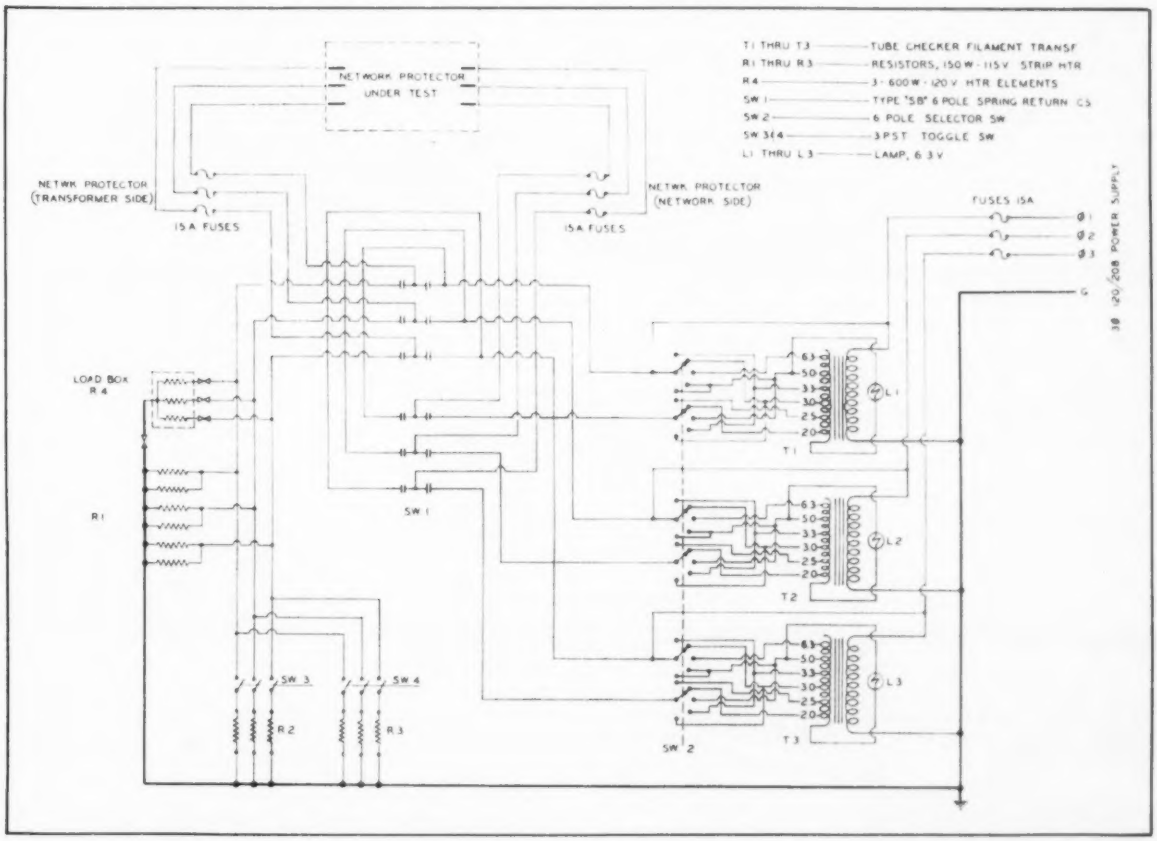
The characteristics of the Mobile underground network somewhat simplified the task in that all primary feeders emanate from one substation and good feeder load balance has maintained practically identical secondary voltages at neighboring vaults served from different feeders. This feature enabled a standardization of test values suitable for all protectors on the network.

Network protector master relays are set to open the protector on the reverse current drawn by the particular transformer bank in service with the protector under test. In all cases this value exceeds 0.2% of the rating of the current transformer of the protector.

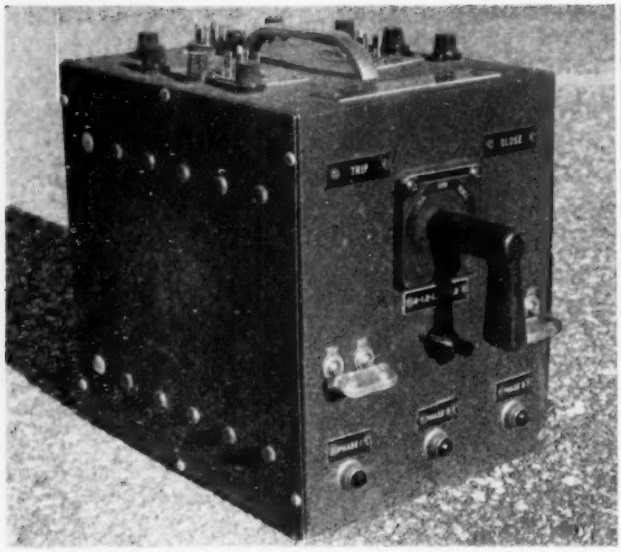
A one volt minimum differential in phasing voltage in phase with network voltage at the protector terminals will cause the network protectors to close. The Mobile network is so arranged that the use of phasing relays is not required to verify existing conditions before allowing the protector to close.

Field test set design

To simplify, as much as possible, the design of the new network protector field test set a simple expedient was employed which



Schematic diagram of the network protector field test set developed by underground engineers of Alabama Power Co., at Mobile. Utilizing a load box and a variable voltage source obtained from a tube checker type filament transformer, the tester is able to similate reverse current and voltage difference.



These closeup views of the network protector field test set show its principal features. Test clips are connected at top by means of connector plugs.

Switches on front control load units for reverse current tests and low voltage application for the protector closing test. The unit weighs 20 pounds.

had played a major role in the mass production tactics during World War II. This was the "go" or "no go" principle. Since the exact setting of the relays was not the goal in this case, upper and lower limits between which the relays would cause the network protectors to function properly according to network conditions were predetermined. The test set was then simply and economically designed to supply these limits.

The result was a light and versatile, easily manageable, compact unit readily operable by any personnel after a brief instruction period. The size has been reduced to 8″ x 10″ x 10″ and the weight to 20 pounds. (See illustration.) The complicated maze of connections previously required for a test setup has been reduced to three simple three phase clip-on operations—one to the network side of the protector, one to the transformer side, and one to a source of secondary power supply. The cost of the prototype network protector field test set, utilizing available labor, was quite reasonable, the entire figure amounting to less than $150.

As may be seen from the schematic wiring diagram, the heart of the test set consists of three ordinary type tube checker filament transformers connected as autotransformers bucking. Appropriately connected through a selector switch, they furnish a series of relatively exact voltages which may then be applied across the terminals of the protector under test.

Since 1.0 volt has been set as our standard reclosing voltage, the tube checker transformers have been connected to provide 0.8, 1.0, 1.3, 1.7, and 2.0 volts across the protector terminals. Thus 0.8 volt applied is the "no go" value while 1.3 volts is the "go" value when testing reclosing characteristics of a 1,600 ampere protector. The "go" or "no go" values naturally vary with the protector ratings.

Trip testing is accomplished by actually drawing reverse current through the network protector and its master relay. This is done with the use of a series of 150 watt, 115 volt strip heaters connected to the network transformer side of the test setup. One set of resistors remains permanently connected to the circuit. These may be considered as representing the charging current of the transformer bank. The other two sets of resistors are switched and are utilized to vary the value of the reverse current.

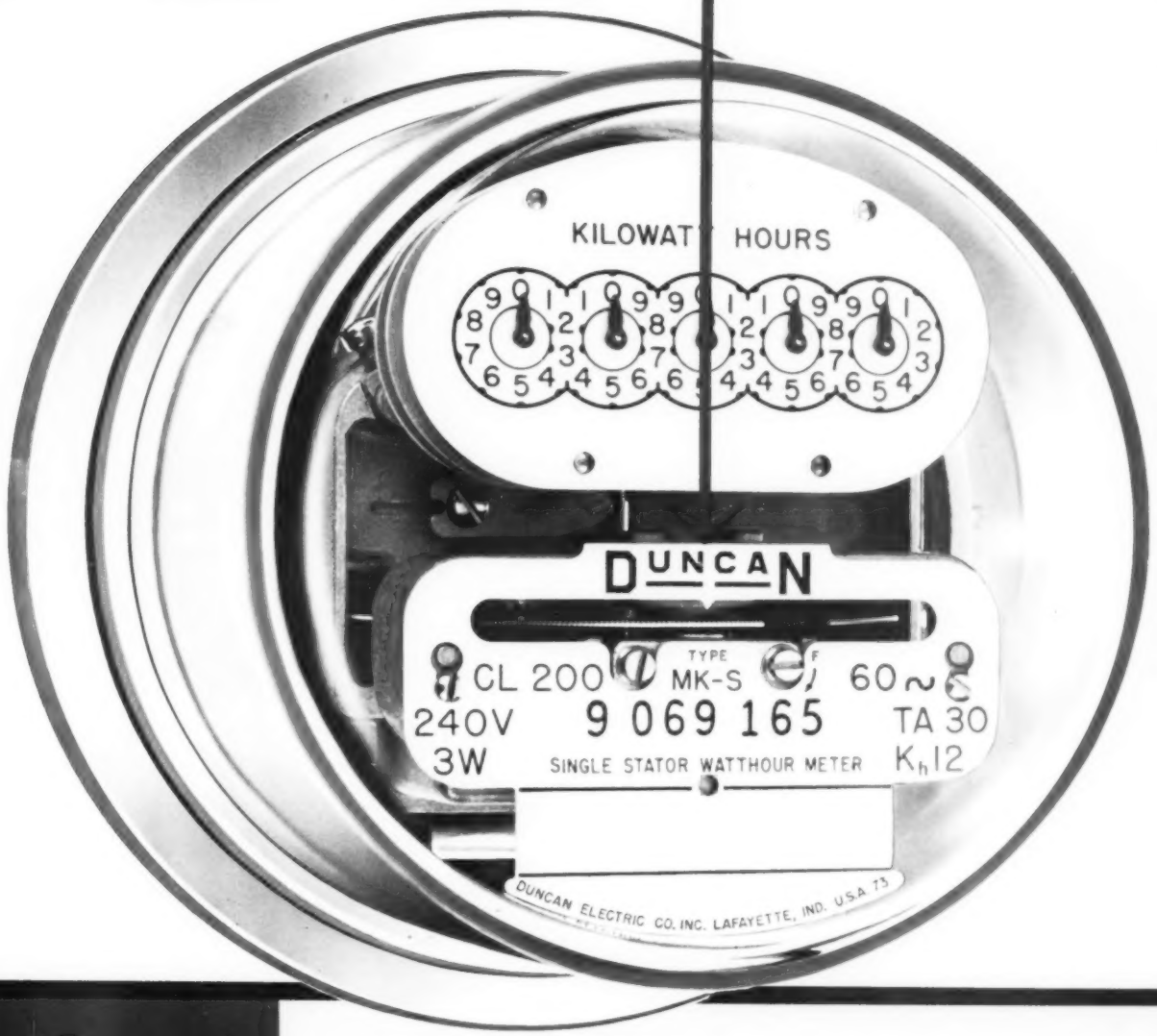
With only the permanent resistance load on the circuit, the reverse current is of an insufficient magnitude to cause the relay to trip a 1,600 ampere protector. This then is a "no go" value. With switch #3 closed, adding more load, the resultant current drawn will cause a 1,600 ampere protector to trip but is still insufficient to operate a 2,000 ampere unit. Thus a "go" value is provided for the lessor rated protector while this same value is a "no go" figure for the 2,000 ampere size.

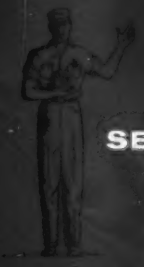
The closing of switch #4 adds still more resistance load and in turn draws reverse current which provides the "go" value for the 2,000 ampere protector. The limits for the 2,000 ampere protector also apply to the 2,500 ampere units which are the largest in use on the Mobile underground system.

To cope with unusual requirements or conditions at certain locations, a supplemental load box consisting of three 120 volt, 600 watt heater elements has recently been added to the test equipment. A four wire plug is provided in the top of the box for insertion of this extra resistance load into the circuit should still additional reverse current be required for proper setting of the relay.

As may be seen from the illustrations, no meters comprise any part of the field test set. It is truly a field instrument requiring only reasonable care and handling. In the course of the testing procedure, should a relay perform suspiciously or be obviously in trouble, it is replaced with a spare and returned to the shop for prop-

(Continued on page 121)





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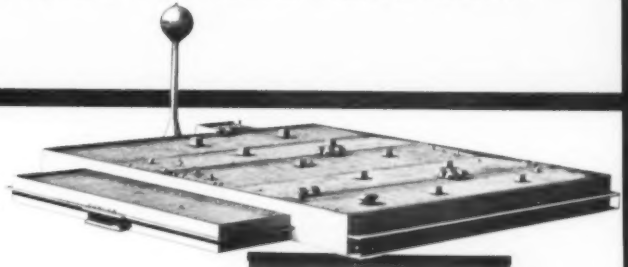

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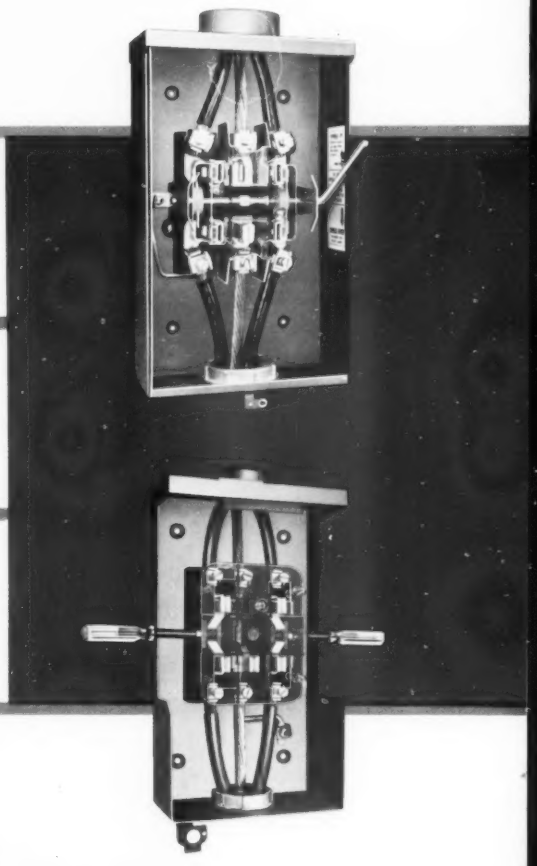

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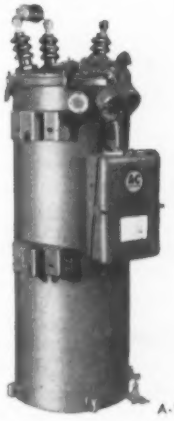

A-1216

Basic data on heat dissipation and current carrying capacity of electrical conductors - 1

By Fred C. DeWeese
Consulting Engineer
Raleigh, N.C.

This is the first of a series of several articles on the subject of heat dissipation and current carrying capacity of electrical conductors. Well known as an experienced transmission and distribution engineer, the author will present a considerable amount of previously unpublished data in this series.

◆ THE CAPACITY of a conductor carrying electric current is limited only by its ability to dissipate heat in the form of I^2R losses at a sufficiently rapid rate to maintain its temperature within certain prescribed limits above that of the surrounding air. In the case of high voltage transmission lines, the limiting factor is usually not one of heating but of voltage drop. When the line conductors are such as to provide economical operation, the temperature rise is not an item of importance.

In the design of transmission lines and distribution systems three dominant factors enter into the problem with respect to the selection of a conductor.

(a) It must have ample mechanical strength to withstand the stresses imposed by combined ice and wind loads at low temperatures with a reasonable factor of safety.

(b) It must be of such size and kind of material to make possible the transmission of anticipated loads at a given voltage with an allowable voltage drop.

(c) The heat generated by the I^2R losses should not be such as to produce excessive power loss or temperature rise of the conductor.

Temperature rise is usually not an item of importance in connection with lines operating at transmission voltage, since to transmit power, economically, any considerable distance, the I^2R losses should be relatively low. On the other hand, with systems operating at comparatively low voltage, especially in metropolitan areas where heavily loaded circuits of comparatively short length prevail, heating effect of load current may be the deciding factor insofar as the size of conductor is concerned. Naturally, such load conditions require conductors of comparatively large cross section, not only to provide for a minimum of I^2R losses but to maintain the temperature within safe limits.

Very probably the most severe conductor loading to confront the designer is in the case of circuits to be installed in transformer vaults where air temperatures are usually higher than normal due to the heat given off by loaded transformers, especially where the ventilation is not too good. This type of installation requires lar-

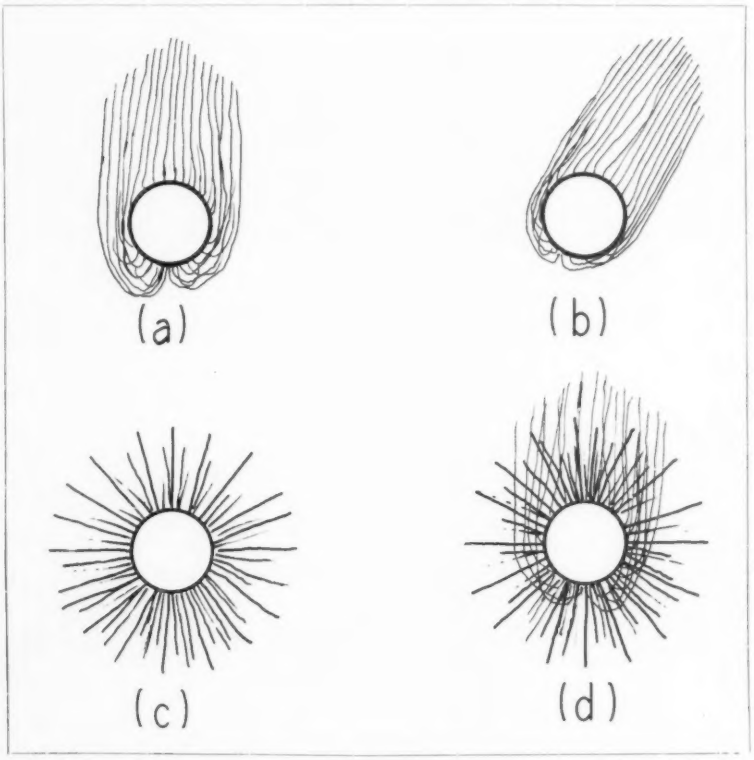

Fig. 1—How heat generated by I^2R losses is dissipated by electrical conductors: (a) free convection; (b) forced convection; (c) radiation; (d) combination of both convection and radiation.

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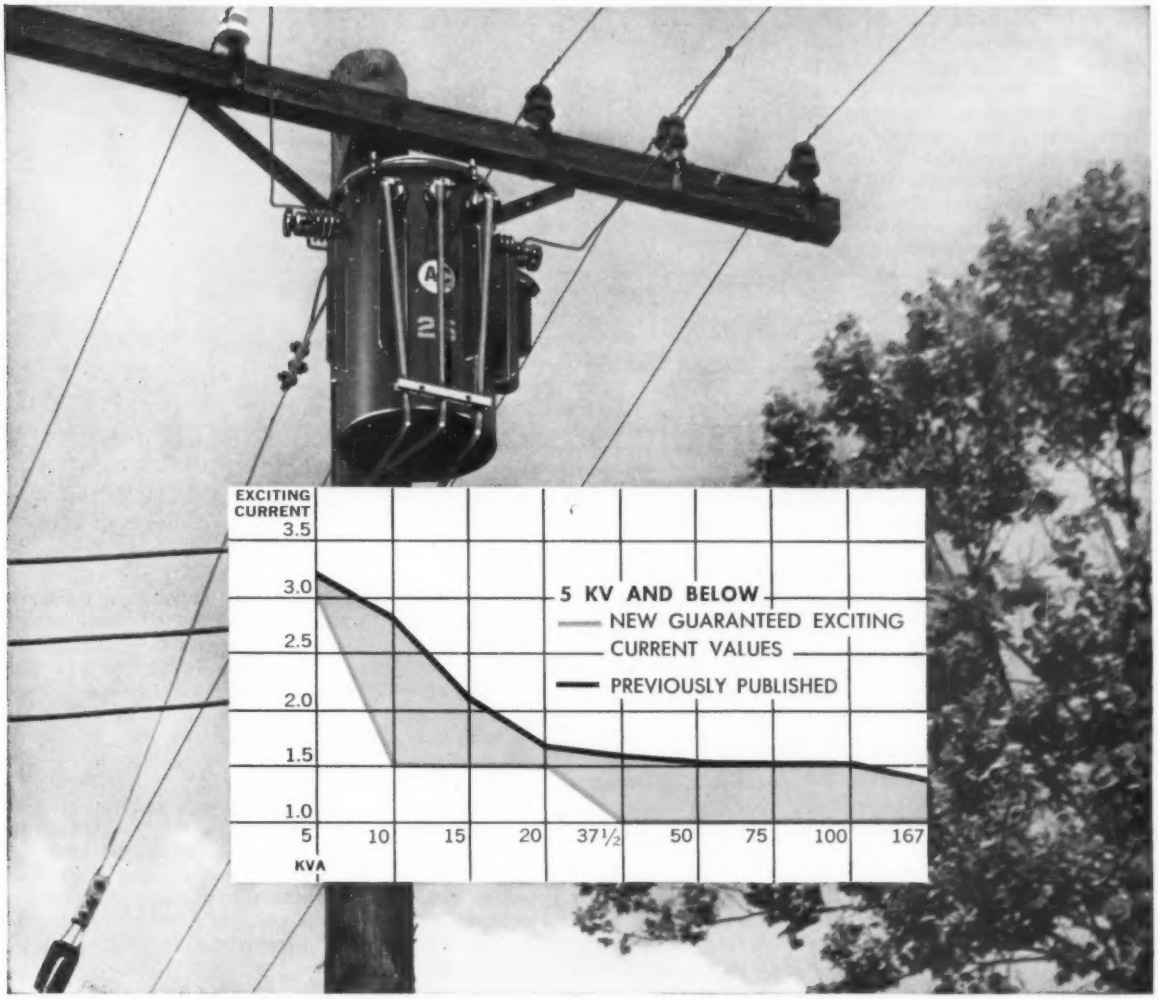
A-1253



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ger conductors than would be required under more normal conditions.

There are two separate and distinct methods by which heat produced by the I^2R losses in a conductor is dissipated, i.e., "convection" and "radiation." Fig. 1-a represents heat dissipation by free convection. When conductors are installed indoors or in locations where there is no forced air circulation, heat dissipation is limited to that which can be carried away by the natural convection air currents. That is, the permissible current for a given temperature rise is limited by the heat that can be carried away from the conductor by free movement of the warmer air resulting from the I^2R losses in the conductor. In the absence of crosswise air currents, the warmer air will ascend vertically as indicated by the lines representing heat waves.

In Fig. 1-b, we have a representation of heat dissipation by "forced convection." Because of the crosswise currents of air, heat is dissipated or carried away at a more rapid rate than is the case with free convection. As a result of this the temperature rise of the conductor above that of the surrounding air will be less for a given value of current. Conversely, the current carrying capacity of the conductor will be greater for a given temperature rise. Also due to the crosswise currents of air the heat waves will be deflected from a vertical to an inclined position, somewhat as indicated.

Fig. 1-c represents heat dissipation by "radiation." The radial lines, representing heat waves, are at right angles to the surface of the conductor. The unit heat dissipation by radiation is not affected by the diameter of the conductor but is a function of the absolute temperature difference between the conductor and the surrounding air and a factor known as the "Radiation emissivity coefficient," which for copper of average weathered surface is usually taken as 0.5.

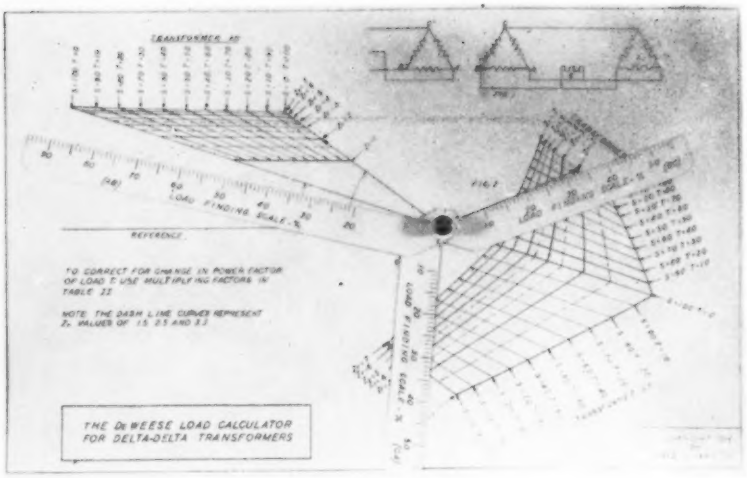
Fig. 1-d represents heat dissipation by both convection and radiation. The heat loss calculations are made separately for convection and radiation and then combined to give the total watts loss per unit area of the conductor surface per unit length.

Convection heat dissipation is a function of the diameter and is not affected by the conductor material. On the other hand, heat dissipation by radiation is a function of the radiation emissivity coefficient which varies widely with the nature of the conductor surface. For copper, authoritative sources give the following values for various conditions of the surface: polished, 0.03; shiny, 0.07; slightly oxidized, 0.3; normally oxidized, 0.5, and heavily oxidized, 0.7.

Heat dissipation is not affected by the conductivity of the material, although the conductivity has a decided effect on the current carrying capacity of a given conductor. The lower the conductivity of a given wire or cable, the less will be its current carrying capacity for a given temperature rise.

Previously published data on the subject of current carrying capacities of electrical conductors give results that vary over a wide range, even when applied to the same size conductor and temperature rise. To determine by experiment results that could be relied upon, Woll and Gable ran a series of tests on various sizes of copper wire and cable at the Massechusetts Institute of Technology. (See Electric Journal, November 1926). These tests produced results, according to the authors, that differ only slightly from those derived from the Luke formula, but differed widely from those derived from the Pender formula.

Very probably the most authentic and complete information available with respect to "heating and



Transformer loads checked quickly with device developed by DeWeese

◆ A CALCULATING DEVICE developed by F. C. DeWeese, well known engineer and author in the field of transmission and distribution, will provide quick and reliable answers to transformer loading problems.

It is applicable for use with delta-delta or 4-wire primary-delta secondary connected transformers, serving loads consisting of all single-phase, all three-phase, or any combination thereof.

The calculator, shown in the illustration, is constructed of laminated plastic with no exposed lettering. It is 7¼ x 11 inches, with three movable scales, one for each unit in the bank, from which the load taken by each transformer, in per cent of the load served by the bank, can be read to a higher degree of accuracy. From these readings the maximum safe load and the load on each unit is readily determined.

Letter size mimeographed descriptive matter and instructions for use of the calculator, with illustrative examples and multiplying factors to correct for change in power factor of the three-phase load, accompany the calculator.

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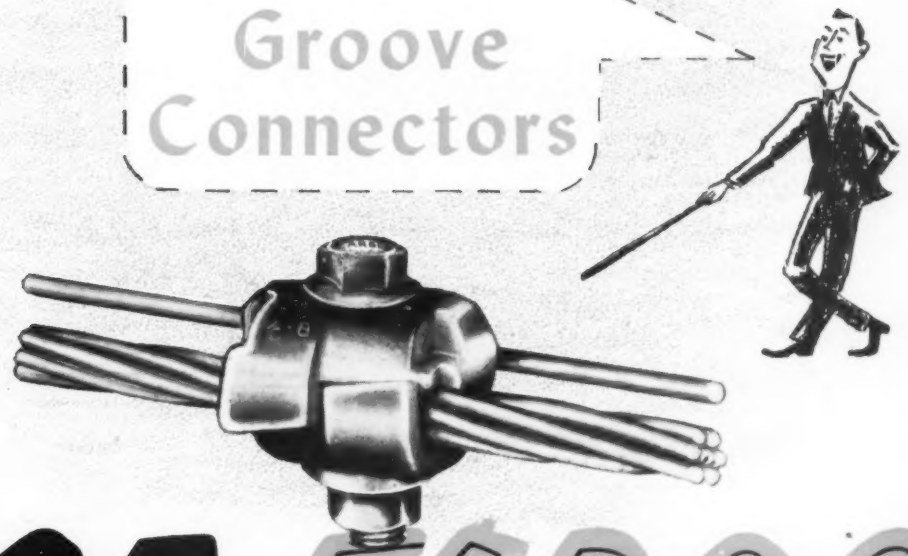

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4. built in spring action maintains contact pressure under changing loads.

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6. a wide range of conductor sizes can be accommodated in each connector for aluminum to aluminum or aluminum to copper connections.

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current carrying capacity of electrical conductors" is that presented by Schurig and Frick. (See General Electric Review, March 1930 and August 1931).

Schurig and Frick conducted an extensive series of tests on conductors installed indoors, in large and small rooms; outdoors at various elevations and degree of protection, such as being shielded by buildings, no shielding, etc. Formulas were developed from which results may be derived that agree quite closely with test values under similar conditions. It should also be mentioned that values derived from the Schurig and Frick formula's check closely with those presented by Woll and Gable at an earlier date.

While the Schurig and Frick methods were used as a basis from which to derive the values presented here, the value of the material is considerably enhanced by

(Continued on page 121)

Aerial cable system features special components

◆ SPACER TYPE aerial cable systems are proving an economical and practical way to avoid a clutter of overhead lines in the country's fast growing communities and industrial areas.

One of the newest spacer systems nationally available to the electrical trade has been developed by Kaiser Aluminum & Chemical Sales, Inc. featuring a simply designed spacer, a new high-strength aluminum messenger, and insulated phase conductors specially constructed for use with spacers.

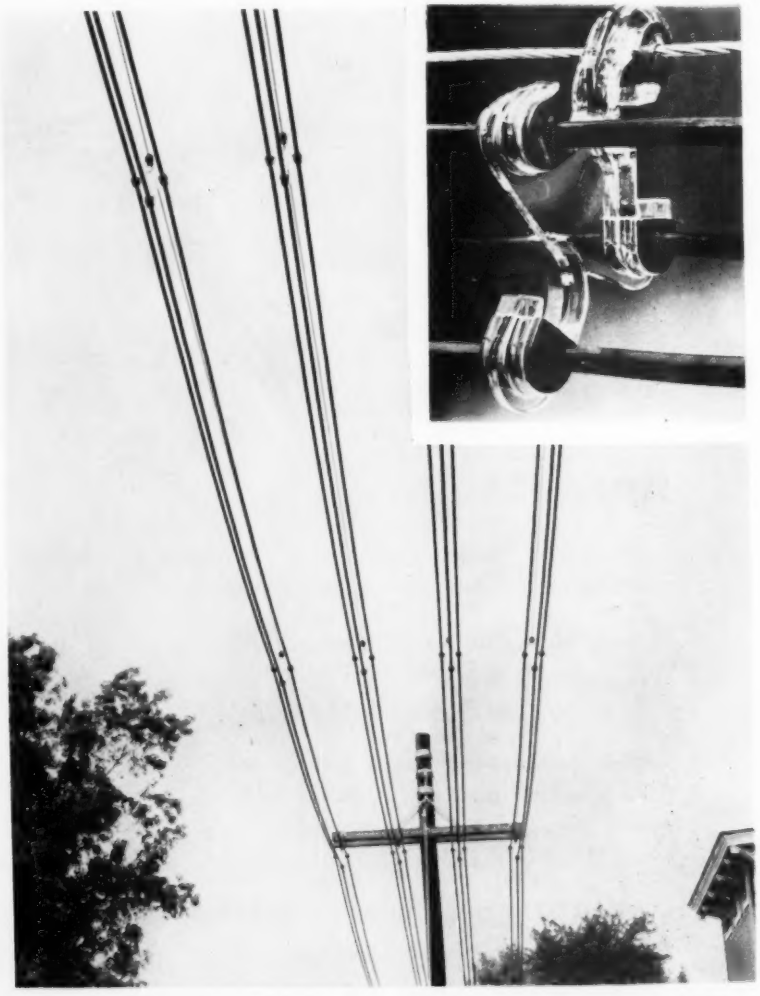
"Because all the elements of the Kaiser Aluminum spacer system are designed to be used together," states J. C. Ferguson, general manager of the Electrical Conductor Division, "an entire system, installed, costs considerably less than preassembled aerial cable and only slightly more than standard open wire."

The Kaiser Aluminum spacer, designed for systems operating at 5 to 15 kv, is a compact, high strength, one-piece Plexiglas unit with neoprene grommets. The grommets, slotted to slip around the cable, snap easily into the spacer's guide paths, but are held securely once they are in position. Only one cable need be handled at a time and installation of each spacer takes but a few minutes. With no movable or removable parts, the spacer has an extremely high degree of mechanical reliability.

The cables are held six inches apart providing a neat appearing system with easy phase identification.

The 3/8-inch aluminum messenger, composed of seven strands, has two strands of EC grade conductor and five strands of Alumoweld. It was designed by Kaiser Aluminum to combine high strength with low resistance. Other types of messengers are also available for use with the spacer system.

Phase conductors are of hard drawn EC grade aluminum with a minimum conductivity of 62 per cent IACS. Both polyethylene and butyl rubber insulations are available with neoprene jacketing.



This view of the power lines serving American and Efird Mills, Inc., textile operations at Albermarle, N.C., demonstrates neat appearance of aerial spacer cable system. Inset shows details of Plexiglas spacer and neoprene grommets which hold cables and messenger in place.

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Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

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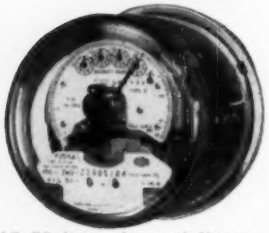

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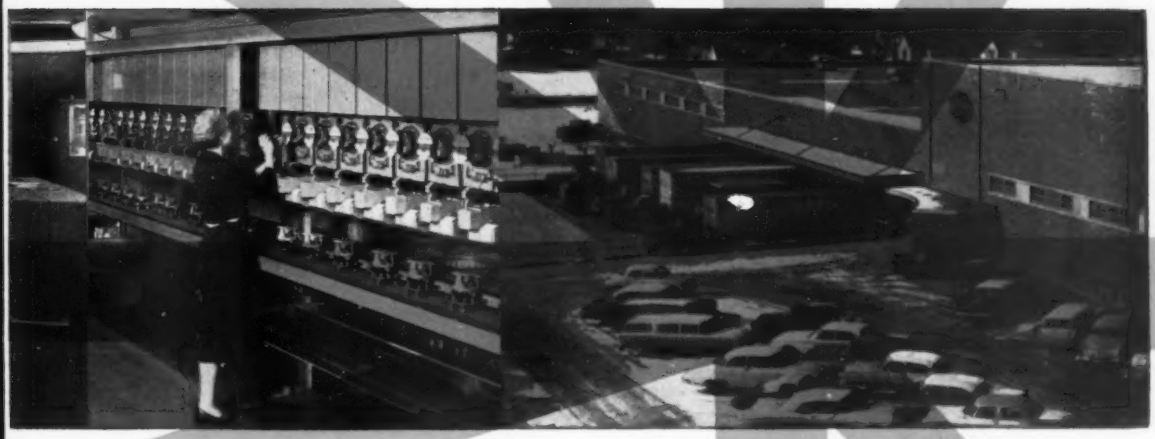

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JH60-1

Lightning protection on distribution circuits

Part 2: Existing construction

By H. L. Deloney
Assistant Chief Engineer
Louisiana Power and Light Co.
New Orleans, La.

◆ THE PREVIOUS article discussed the lightning protection methods being applied to new distribution circuit construction. Our biggest remaining problem in the lightning proofing field is: what to do with the older lines built before shielding was adopted as a policy?

Some of these lines just naturally are supplying very important loads and areas. The economics here are quite different, though, due to the high costs involved. Shielding of existing circuits costs from $1,500 to $2,500 per mile as contrasted with $400 to $500 on new circuits. This is due to quite a few factors, namely:

(a) A second neutral must be strung, duplicating the secondary neutral, since it is usually impractical to remove and relocate that neutral to the top position.

(b) A bayonet extension must be added to lengthen the pole height.

(c) Additional insulators must be cut into dead end strings, or guy insulators must be cut in.

(d) Steel cross arm braces must be replaced with wooden braces.

(e) If the circuit involved is important enough to be shielded, it usually can't be taken out of service, so all work must be done "hot."

We have made considerable progress on lightning proofing of our older lines and are considering a 4 or 5 year plan for programming the balance of the more important circuits. The portion of feeders to get first attention in this program will, in general, comprise the main three-phase section of the individual circuits from the station feeder breaker to the first automatic sectionalizing point.

Some of the existing circuits have already been shielded, involving the factors just enumerated in the above cost considerations. Others have been taken care of by use of lightning arresters, and several hundred miles have been shielded as occasions arose to rebuild circuits. These occasions in many cases have been brought about by overloads, and physical condition of the plant, but in most cases have been due to road widening programs going on throughout our territory.

Valve arrester application

One instance where valve type lightning arresters have been applied very successfully involves a 7-mile triple circuit, 13,800 volt feeder near New Orleans, which supplies several large industries. Lightning outages on the circuits, involving both equipment and structure damage, were causing excessive loss of production in several of the plants employing continuous processes. Something had to be done!

Shielding of this triple circuit "hot" appeared to be such a dangerous and costly project that it was decided to install lightning arresters on the three top conductors on about every second pole, forming a shield for the six conductors on the two bottom arms.

The circuit was analyzed to determine structure most suitable for mounting the arresters, usually those not having distribution transformers connected to either of the bottom two circuits. Steel cross arm braces were replaced with wood on the two bottom arms in order to raise the BIL of the two lower circuits with respect to the down lead of the lightning arresters being installed on the top circuit.

It was not necessary to remove the steel braces on the top circuit where arresters were applied since the arresters themselves protected against power follow from the top conductors at that point.

On intermediate structures where no arresters were installed, it was not necessary to replace any of the steel braces, since we had the BIL of the phase insulators, the wood in the top cross arm, the wood in 4 feet of pole, then the wood in the second cross arm, and the insulators of the second circuit, to discourage flash-over from the top circuit to the next. Strokes to the top circuit on or near the intermediate structures were provided a path to ground in both directions through the arresters on adjacent structures.

The installation described above has been in operation for about five years and has given almost a perfect performance record, with only one incidence of arrester failure.

Another application of arresters involves approximately 24 miles of triangular configurated 34.5 kv construction operating at 13.8 kv. Here, advantage was taken of the configuration, and arresters were installed on the top phase conductor, with only one arrester per structure being involved. Since span length was in the order of 250 to 350 feet, it was decided to protect each structure.

Performance of this circuit has been very good with the exception of several arrester failures. Here, expulsion arresters were employed, and the cause of failure was attributed to faulty horn fiber, used in the arrester manufacture, and to the excessive humidity of the area climate.

Valve arrester on 34.5 kv

In the previous article, I mentioned that we were experimenting with one 20 mile circuit of 34.5 kv, utilizing arresters. This installation is being tried in search for a solution to lightning proofing of approximately 500 miles of 34.5 kv line which was built prior to the adoption of our shielding policy. Since most of these lines utilize pole top pin construction, which

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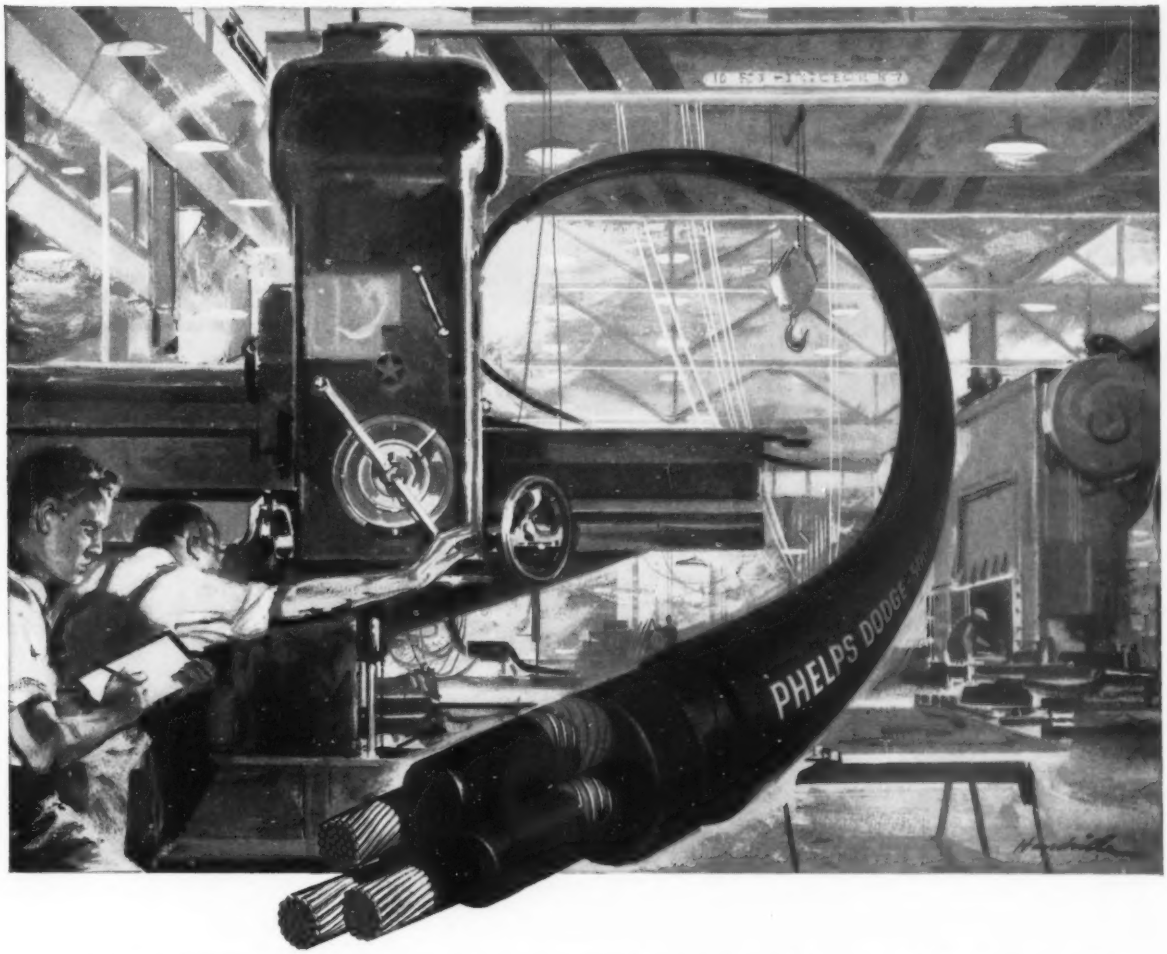

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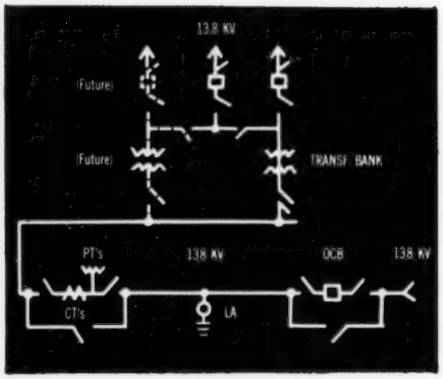
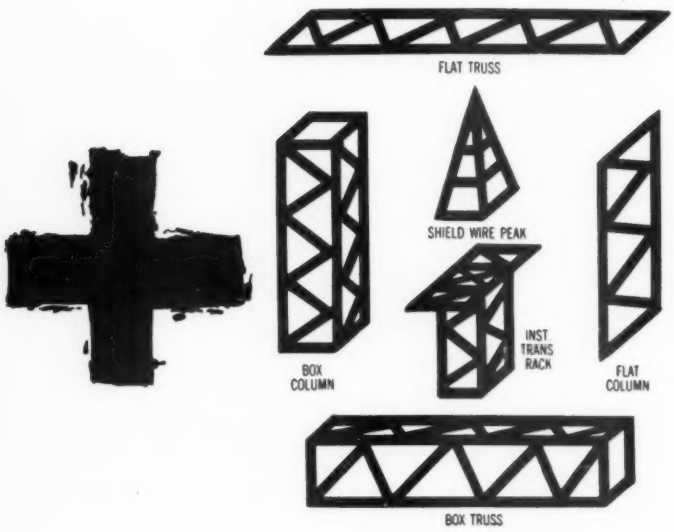


STATION DIAGRAM



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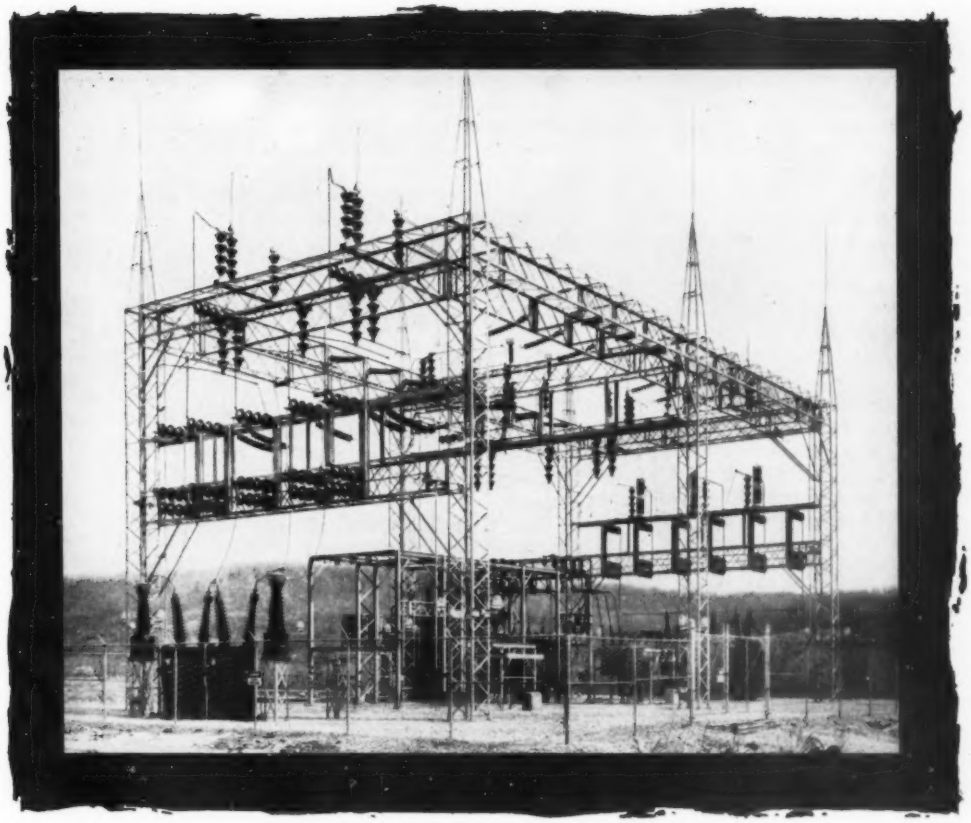

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does not lend itself to bayonet extensions for the shield wire without changing out the cross arms, we were looking for a method of protection other than shielding.

Conventional expulsion tubes were not applicable in most cases, due to the wide variety of available short circuit current under various conditions of back-feed and source connections to which the circuits are subjected, and due to the limited range of capability of a given expulsion tube rating.

The valve type arrester appeared to be a practical solution, but no distribution type arresters were available for the voltage class involved. The lowest cost arrester available was in the "intermediate" class and sold for $165. The physical size and mounting arrangement also did not adapt itself for direct pole mounting of the arrester.

We prevailed upon one of the manufacturers to look into the design of a 30 kv distribution type arrester on the basis that we and other 34.5 kv users would have application for such an item for protection of lines and distribution equipment in this voltage class, since much of our future distribution must go to the higher voltages.

This manufacturer subsequently produced a design which looked acceptable, and we agreed to put up a test installation of 240 arresters on this 20 mile section of line. The arrester price turned out to be approximately $75 compared to $165 for the "intermediate" class. With this arrester available for use, we were able to complete the installation at approximately $1,200 per mile.

The test circuit

The circuit selected for the test was "guaranteed" to give an accelerated life test because of 12 to 15 years record of broken poles and cross arms and other lightning "trip-outs." The circuit runs along Bayou Bouef near the Gulf of Mexico and the 45-foot and 50-foot poles are the highest structures for miles around, except for a few oil well derricks.

This arrester installation involved an arrester on every second pole, on the top phase, with standoff rods to take the down lead away from the pole from the arrester, through the bottom two phases and through a 13.8 kv underbuild to the secondary neutral position. No modifications were required on the intermediate structures.

The installation has been in service for about 5 months to date, and with a lightning storm almost every day, there have been no outages or structure damage except two momentary outages on one day when two arresters were lost. These failures involved successful functioning of the arrester drop-out feature with no circuit "lock-out" being involved.

We do not consider the loss of two out of 240 arresters in this test group to be serious, since they admittedly were not designed for direct stroke conditions, and we consider the lightning exposure in the area during this period far above normal.

Natural trouble spots

It is only fair to relate some of the things we have done wrong that prevented us from getting the most effective results from the various lightning proofing attempts.

The first thing that showed up involved two of our earlier shielding installations, that almost made us believe the "experts" were right. Instead of improving performance, we seemed to have worsened it. Discussion with repair crews developed the fact that they were experiencing line lockout due to flashed over and cracked insulators. It also developed that all failures were occurring on the inside phase.

A trip out to investigate the line quickly solved the mystery. It turned out that the construction superintendent had decided the engineering department must be crazy for having provided fir cross arm braces when he had been using steel braces for 25 years and had never known one to fail. So he left the wooden braces in the storeroom!

As it turned out, I don't know who was right. We replaced the steel braces with fir braces, and the line performance was just about perfect. About five years later, though, the fir braces began to rot out. We hope to have the answer to this, though, in the Apertong wood braces which we have been using for the past 8 to 10 years. I know of no failures to date on this type.

One other case involved a couple of rather heavy conductor circuits just recently built which have had serious trip-outs due to insulator failures. Examination of these installations turned up the fact that the field engineer had decided to use steel arms on dead ends because of the heavy tensions involved and had, of course, backed them up with guys. He had used five 10-inch discs in the dead end strings, but in carrying the inside phase jumper over the arm, he had used a standard 15 kv pedestal insulator on the steel arm. Other cases of close clearances involved guy attachments too near line parts. This, of course, cut the BIL at that point to about 100 kv, and that was where all the trouble was occurring. The solution was simple but costly and two years late.

I could name quite a number of other instances where we built lightning "traps" due to ignorance or oversight, but the point I would like to make is, that it is not only necessary to design around the many lightning "traps" that you can build into distribution circuits, but that you have to do an educational job on all engineers, foremen, and linemen, and let them know why they have to be careful of clearances and insulation level.

Demand meters

(Continued from page 65)

was a "demand" meter, it was "Katy bar the door," and the reaction was normal. They resented the name, "demand" and, therefore, the meter and its implied purpose. They felt that something that smacked of authority had been forced upon them. And all because of one word: "demand."

That damage has been done by calling a meter a "demand" meter is undeniable, but something bordering on stupidity exists when we continue to nourish a bad situation by refusing to admit that the name is misaplied, and misused.

The reason for its introduction, and the very nature of its operation, suggests a much better name. Let's put a name on it more in line with the job it does. It has supplied a means of fair and equitable measurement, and should be known by a name symbolizing this fact.

As a suggestion, and to encourage others, I propose the name of "par meter." "Par," according to Webster, means an "average, or normal amount; a level of equality; and equality in value." This certainly would more aptly define, and better describe, the true purpose of our "demand" meter.

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Leading Electric Utilities Specify WEAVER Equipment for Long-lasting, Trouble-free Grounding

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Heavy, uniform copper coating, molecularly bonded to a rigid steel core, assures permanent grounding. The copper is work-hardened and resists scarring in rocky soil. A special draw gives the core more rigidity and with machined point driving is easier . . . chamfered top eliminates mushrooming and splitting.

GROUND ROD CLAMPS

Cast of high-strength, silicon aluminum bronze, yet cost no more than extruded types of clamps. Design guarantees perfect alignment between ground wire and rod. Big half-inch screw with rounded point gives high pressure contact without damaging the copper on the rod . . . machine-cut threads withstand high torque without stripping or breaking. Available with socket or square heads.

POLE BOTTOM GROUND PLATES

Weaver Plates with 25% more copper area than other types of plates, provide better overload dispersal . . . yet cost no more. It is the only plate with a heavy duty cast bronze connector to give high pressure contact between plate and ground wire . . . assures long-lasting, safe grounding.

J. A. WEAVER Company

Ask Your Electrical Wholesaler for WEAVER Grounding Equipment

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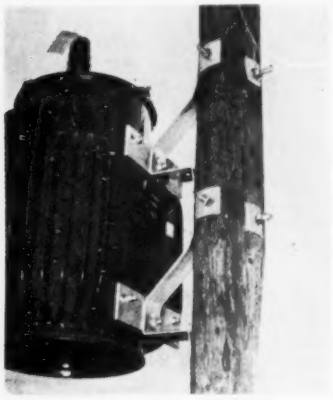
Notes on new utility equipment

Mounting bracket suited to singles or clusters

A NEW TYPE of mount for transformers and capacitors is now being introduced by Minit-Mount Sales Co., 775 Wooster Rd., N., Barberton, Ohio, which is suitable for single units or clusters.

The new cluster mount bracket is designed for installation of transformers, capacitor banks, and line type oil circuit reclosers. Unlike other types, the Minit-Mount is an



adaptation of the pole bolt mounting principle which has proved to be a simple and economical method.

One-man installation is possible with the new bracket because of its light 9-pound weight and simplicity of design.

Supported principally by one horizontal bolt that goes all the way through the pole at the top of the bracket, the new device comes in three sizes, a range which will fit any pole or transformer size. A lag bolt anchors the bracket's bottom section to the pole.

The manufacturer reports that tests show that the bracket can support up to four times the normal maximum loading on transformer and capacitor installations, without showing critical deflection.

Write U-309 on reply card, pg. 20

Network transformer designed for use in vaults or subway

A NEW UNIVERSAL network transformer designed for either vault or subway applications and replacing the two designs formerly necessary is available from the Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30 Pa., in ratings of 300, 500, 750 and 1000 kva at 5, 15, 25 and

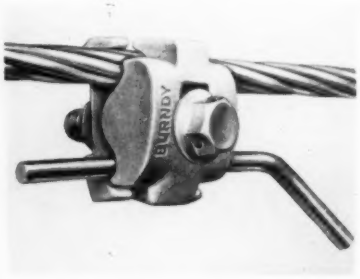
34.5 kv. The universal design permits users to reduce stocks of spare units, and simplify specification writing and ordering information.

Improved corrosion protection for critical welded areas is provided by a better film thickness of paint over the smoother and more uniform automatically welded seams of the unit's coolers. The universal design has 30 percent fewer welds than before, but retains all the advantages of the standard Space-Miser construction—small size, round-cornered tank, and Yukon coolers.

Write U-310 on reply card, pg. 20

Parallel groove clamps have interlocking fingers

INSTALLING overhead line and service connections is simplified by aluminum parallel groove clamps with interlocking fingers, introduced by Burndy Corp., Richards Ave., Norwalk, Conn. An addition to the company's "Tapit" line, the new con-



nectors, designated UGG, accommodate copper, aluminum, and ACSR from No. 8 through 1/0.

Interlocking fingers on the connector body halves prevent rotation and mis-matching. Gripping edges on the hexhead bolt and square surfaces on the connector body facilitate two-wrench installation, while the non-turning square shank simplifies single wrench installation.

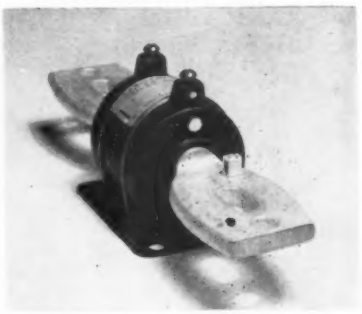
For high conductivity, contact surfaces are etched and coated with oxideinhibiting "Penetrox A" joint compound. To assure compound application and prevent joint failure due to galvanic corrosion, these connectors are available factory-filled with "Penetrox A" and "Stripsealed." Prefilling and sealing connectors also prevents oxide-film formation in storage and makes it unnecessary for installers to handle compound or scratch-brush the connector.

Write U-311 on reply card, pg. 20

New design indoor transformer does same job at lower cost

TO MEET the growing need among utilities for an efficient, low-priced indoor current transformer, General Electric's Meter Department, Schenectady 5, N. Y., has developed a 600-volt model priced up to 40% lower than comparable indoor-outdoor models.

Latest addition to the 600-volt line is the JCX-0. The new butyl-molded transformer is designed specifically for indoor application. It is available with either high base or low base, bar-type construction and in 200, 400, 600 and 800:5 ampere ratings.



Engineers said the significantly lower price of the new JCX-0 was made possible by design simplification and standardization of the eight currently available models.

While materials specifically designed for indoor application are utilized, the new units retain the basic features of the more expensive Type JCA-0 transformers.

Ratio and phase-angle corrections of the new transformer are well within rated parallelograms. Metering accuracy of the 200, 400 and 600

Whenever linemen climb poles to repair or replace transformers, it costs money in lost revenue and added labor costs. These expenses are reflected in your earnings statement.

Capital for utility financing is naturally attracted to companies having a more favorable record of profits and this is why system dependability is one of the keys to utility financing.

every time he goes up—profits go down

Progressive utility management, seeking methods of assuring system dependability, can specify Moloney Transformers which combine superior design with fine workmanship and materials to provide lower operating and maintenance costs.

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MOLONEY ELECTRIC COMPANY

Transformers for
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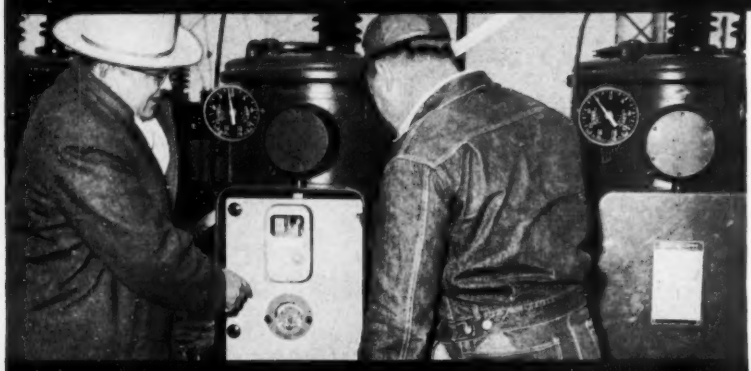
ME60-1

ANOTHER STEP AHEAD IN VOLTAGE REGULATION

APPLICATION ENGINEERING



INSTALLATION SERVICE

LINE CREW TRAINING

RAPID PARTS SHIPMENT

These General Electric Voltage Regulator

SERVICES MEAN SAVINGS

Savings for you through economical application, installation, operation, and maintenance are a big part of General Electric's voltage regulator story.

When you buy reliable G-E regulators you receive these added values in service:

- Engineering assistance during planning stages of modern distribution systems gives you benefits of latest application concepts and computer-augmented system regulation studies.
- Installation guidance on-the-site by G-E regulator engineers assures proper hook-up, continued economical operation.
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- Rapid renewal parts shipment, within 48 hours on common replacement items, cuts outages to a minimum. Nationwide network of G-E service shops stays open 24 hours a day, 7 days a week to give service when you need it—and fast. Quick regulator delivery from *local* G-E warehouses helps you meet storm-caused emergencies.

Service that saves you money during planning, installation, and operation is another reason why General Electric regulators cost less on the line! Ask your G-E regulator representative for detailed information. General Electric Company, Schenectady 5, N. Y. 456-01

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GENERAL ELECTRIC

ampere models at 60 cycles meet requirements of ASA class 0.3 at B-0.1 and B-0.2 burdens and is 0.6 at B-0.5. The 800-ampere model is 0.3 at all three burdens.

Write U-312 on reply card, pg. 20

Stringing block eases installation of cable

A NEW STRINGING block, available from Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis., provides an efficient, simple, and economical means of installing spaced aerial cable. The open design of the stringing block permits easy

placement and removal from both the support messenger and the insulated cables.

Opposing-offset design assures positive trolley action of the stringing stringing operations. The stringing block utilizes standard spool-type insulators to support the insulated cables.

Write U-313 on reply card, pg. 20

More power, less weight for pole transformers

A NEW 333-KVA distribution transformer suitable for pole or platform installation has been announced by Pennsylvania Transformer Div., McGraw-Edison Co. Box 330, Canonsburg, Pa. The unit is an addition to Pennsylvania's line of "Featherweight Pole Star Transformers," which now includes single-phase ratings of 167, 250 and 333 kva, 15 kv and below.

According to the manufacturer, Pennsylvania's new 333-kva transformer is lighter and more compact than the station-type unit it replaces, and also provides better regulation. The average impedance is 2.5 to 3%, compared to an average of 4 to 5% for station-type transformers.

By extending its pole-type design to 333-kva, Pennsylvania continues the trend toward more power per

pole that it originated in 1953, when the company introduced the first transformer of greater than 100 kva ever to be designed for pole mounting. Both initial costs and installation costs are said to be lower than for comparable station-type units.

Write U-314 on reply card, pg. 20

Load interrupting switch designed for indoor use

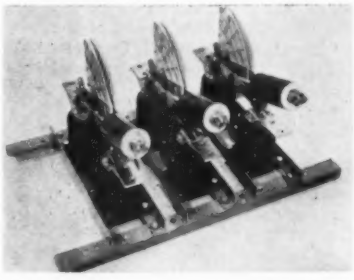
A NEW TYPE a-c indoor switch capable of interrupting load currents is in production by the Electrical Engineers Equipment Co., 1520 N. 25th Ave., Melrose Park, Ill.

Load interruption is accomplished by means of an auxiliary switch blade which, operating in conjunction with the main switch blade, breaks an arc drawn between two high arc resistant silver tungsten alloy contacts in polyester plates comprising the auxiliary switch housing.

The auxiliary blade speed, which is independent of the speed of the operator, together with the deionized gases evolved by the polyester plates, safely and surely breaks the arc.

The switch is simple, with few parts, many of which are interchangeable.

The main switch, basically a disconnect switch with coined silver overlay contacts on high electrical grade copper blades, has a nose mass on the front contact and extended tips on the blade to bear the brunt



of an accidental fault closing, thereby protecting main current carrying surfaces. These same front contacts and blades are replaceable, if ever necessary.

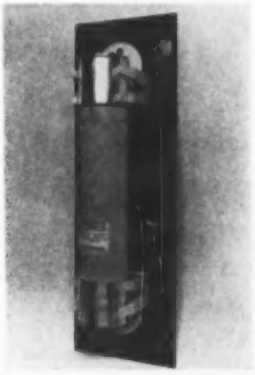
Porcelain inserts in the links insulate the operating mechanism and shaft from the switch poles. A spring closing mechanism will be optionally available to make the switch panic-proof in the event of closing in on a fault.

Write U-315 on reply card, pg. 20

Current limiting fuses in Allis-Chalmers line

INTRODUCTION of a new line of totally-enclosed, sand-filled current limiting fuses (Type FM) in ratings of 2,400 to 4,800 volts for use in high voltage motor controllers has been announced by Allis-Chalmers, 938 S. 70th St., Milwaukee 1, Wis.

Low in initial cost, requiring little space and providing completely self-



contained interruption, the fuse's current limiting action minimizes possible damage to other equipment by reducing thermal and magnetic stresses.

The new fuse consists of silver elements surrounded by dry inorganic sand all enclosed in a strong glass polyester base insulating tube. The fuse is connected into the circuit by means of silver-plated copper ferrules on each end of the tube. The silver elements are internally connected to the ferrules which are completely silver-plated to maintain low resistance in its supports when the fuse is mounted.

Write U-316 on reply card, pg. 20

Pole-top meter entrance for underground circuit

HI PRODUCTS, INC., 7700 Wentworth Ave. S., Minneapolis 23, Minn., a division of General Electronic Control, Inc., has recently developed a new Hi-Liner series UMB-200 pole-mounted meter entrance cabinet to complement the Hi-Liner pole-top

*Trademark

"Superforms* help me insure Uninterrupted Service" ...TRANSMISSION ENGINEER

"Superforms help me accomplish my Number One Job Function:

"*Keeping millions of dollars worth of equipment in constant service for many thousands of customers.*"

Transmission Engineers not only must know the requirements for their lines . . . they must also see that they are met. And, they have found that Fanner Superformed products are always reliable. A-1598A

FANNER Superformed with a "PROTECTIVE TWIST"

ARMOR RODS . . . Protect long-span T&D lines at supports

LINEGUARDS . . . Protect short-span T&D lines at supports

PATCH RODS . . . Repair damaged conductors

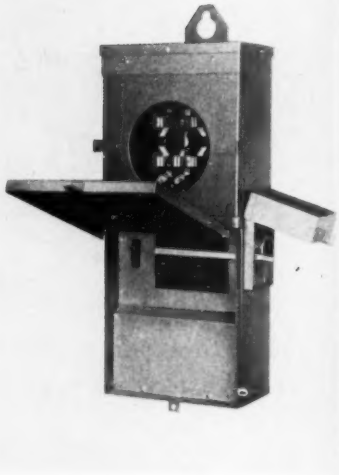
TAP ARMOR . . . Protects conductor at tapping points

FANNGRIPS . . . For dead-ending strands and conductors

FANNSPLICES . . . Join two ends of conductor wire

PLASTIC PRODUCTS . . . For conductor surface protection

FANNER
The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.



entrance line. The new series provides a 200-ampere circuit breaker service entrance for use with underground secondary systems.

The UMB-200 cabinet contains a 200 ampere meter socket, 200 ampere circuit breakers with overcurrent protection, a secondary wiring trough and terminal strip all in one compact, pre-wired package. The circuit breakers provide the main disconnect at the service pole to conform to the requirements of those areas where disconnects must be used when going to 200 amperes and above. For areas where power use requirements are below this range, the UMB-200 may be equipped with circuit breakers of lower amperage. The lower rated breakers can be installed for accurate coordination with distribution transformers already in use—and the circuit breakers may be supplied in dual ratings of 30, 40, 60, 80, 100, 140 and 180 amperes.

To further add versatility to the system, an extra 30 ampere breaker may be added to the 200 ampere main breakers for water heater or pump service. The smaller breaker may be controlled independently for non-interrupting service when servicing other electrical circuits.

Write U-317 on reply card, pg. 20

Porcelain cable spreader withstands powerful force

FARGO Manufacturing Co., Inc., 845 Main St., Poughkeepsie, N. Y., announces their new porcelain "S-1" aerial cable spreader. The porcelain construction provides known long term dielectric and mechanical strength.

Six inch on center spacing of the conductor makes the "S-1" ideal for 5kv or 15kv installations. It is mechanically capable of withstanding the forces generated by faults in excess of 10,000 amperes and will support minimum dead weight loads of 1500 pounds. The weight of the preader (4¼ lbs.) dampens vibration and whipping under wind or hort circuit conditions.

A universal type mechanical connector for use on the neutral assures permanent positioning of Fargo's preader in the span.

The porcelain and "V" groove jaw design eliminates the need of grommets and provides a range over insulation from ½-inch to 1½-inches. The blue-gray glaze of the porcelain blends with the surroundings.

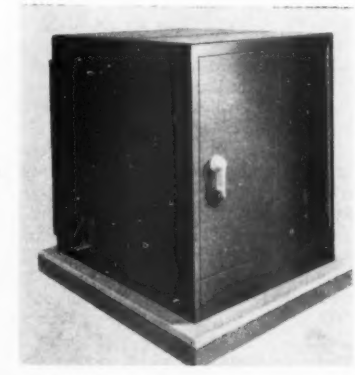
The new aerial cable spreader is distributed by Line Material Industries, Milwaukee, Wis.

Write U-318 on reply card, pg. 20

Wagner introduces new line of pad mounted transformers

WAGNER ELECTRIC CORP., 6400 Plymouth Ave., St. Louis, Mo., announces a newly developed line of Sub-Urban pad mounted distribution transformers. These transformers are designed for surface mounting on a concrete pad, through which both the primary and secondary underground cables are brought into a tamperproof enclosure for connection to terminals.

Pad mounted transformers are selected by builders of many new resi-



dential and commercial developments employing underground distribution systems, primarily because the transformers can be screened with shrubbery so as to blend into the landscaping. In addition, they provide maximum operating efficiency, service continuity, complete safety, low maintenance cost, and are easily adapted to handle future load growth.

Wagner Sub-Urban pad mounted transformers are built in single-phase ratings 25 through 167 kva and three-phase ratings 75 through 500 kva, 15 kv and below.

Write U-319 on reply card, pg. 20

Power pedestals equipped with eyebolt terminals

POWER PEDESTALS equipped with eyebolt terminal strips are available from Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis. Designed primarily for use with Transclosures and pad-mount transformers, these pedestals facilitate above-ground connections of underground services to secondary mains. The pedestals will accommodate 18 conductors, six 4/0 mains and twelve 2/0 services.

Outstanding features of these pedestals are application versatility, design simplicity, and low-cost construction. A large, smooth, removable dome simplifies maintenance and projects above ground for easy location.

Provisions for padlocking make these pedestals tamperproof and restrict access to authorized personnel. All live components are insulated to afford safe installation in residential areas. Tin-plated bronze eyebolt terminals accept conductors from No. 6 through 4/0 stranded. Hot-dip galvanized ferrous parts assure long service life.

Four-inch fibre conduit risers can be accommodated for protecting conductors below ground level.

Write U-320 on reply card, pg. 20

The LA-45 is a good example of Southern States quality

Close examination of the design and construction of this 45° elbow connector will reveal many of the qualities common to Southern States fittings: silicon bronze hex-head bolts, recessed for one-wrench installation; rough-ground contact surfaces; extra ruggedness without excess bulkiness; good design.

Southern States also offers a full line of weldments.

SS SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA Dominion Cutout Co., Ltd., Toronto

Here's a new idea to help you sell electric heat

Electric heating promises to be the electric industry's biggest load builder in the next decade. Advancements in insulation and equipment now make it practical and efficient for any climate.

For the many utilities aggressively promoting electric heating, here's important news: To assist and tie-in with the big job of selling electric heat, Kuhlman offers a new dramatic symbol—a gold transformer to identify electric heating and the all-electric, gold Medallion Home.

The Kuhlman Gold Transformer program ties right into the industry's great drive for electric home heating. It will establish a bright, attractive, easily-recognized symbol that will get the public's attention and approval.

It's backed by a *selling* campaign, with advertising, sales promotion and sales helps to back up the Gold Transformer as a symbol for electric heat.

The Kuhlman representative in your area has all the details you'll want. Call him now!

KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Michigan

Manufacturers of transformers since 1894

Southern Division: CRYSTAL SPRINGS, MISSISSIPPI

LOOK FOR THE GOLD TRANSFORMER, SIGN OF ELECTRICALLY-HEATED HOMES

Wanted: Manuscripts for publication

The editors of Electrical South will welcome contributions from the field for publication. Electrical contractors, consulting electrical engineers, light and power company engineers, and others closely associated with the electrical industry are invited to submit articles, photographs, and drawings relating to important and interesting electrical projects in the South and Southwest.

Articles are wanted in two principal classifications:

Wiring and Lighting: **Articles on interesting and unusual electrical installations; any phase of electrical contracting such as business promotion, estimating, handling men and materials, etc.**

Utility Engineering: **Articles relating to any phase of transmission, distribution, and metering, including design, installation, testing, and maintenance. These articles should be "by-line" articles carrying the name of a Southern or Southwestern light and power company.**

All articles will be given careful consideration and payment will be made promptly for all material accepted for publication.

Address all communications to the editor:

Electrical South
806 Peachtree,
Atlanta 8, Ga.

RESISTS CORROSION

This new super line of "Chem Marine" devices are engineered from corrosion resistant materials capable of withstanding the harmful effects of moisture, brine, grease, oils and many acids. They are designed for industrial applications such as plating rooms, shipping platforms, yards, shops, warehouses, or wherever corrosion or chemical action is a problem.

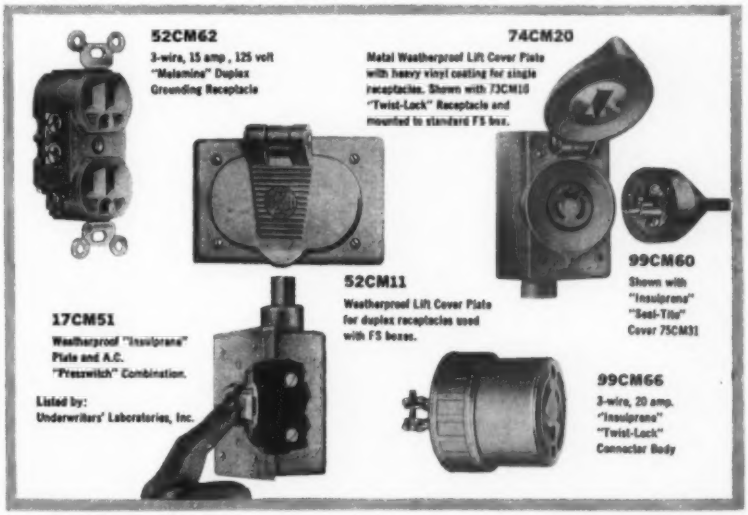
Special Materials:

"INSULPRENE"—a Du Pont neoprene compound.

"MONEL® METAL"—Reg. Trademark of INCO.

"MELAMINE"
"CYMEL®"—Reg. Trademark of Am. Cyanamid

HEAVY NICKEL-PLATED CURRENT CARRYING PARTS.



"Chem Marine" devices are identified by their bright yellow color and a few representative items are illustrated above. For complete information contact the "Chem Marine" Department, —

HARVEY HUBBELL, INCORPORATED
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News of the industry

edited for Southern readers

NAED convention theme "Let's make some money!"

"LET's Make Some Money!" will again be the theme of the 52nd annual convention of the National Association of Electrical Distributors to be held in Dallas, Texas—May 1 to 4, 1960. This is the same theme carried over from the very successful 51st NAED convention last year in Chicago.

Convention sessions and conference booth center activities will take place at the Memorial Auditorium. The convention headquarters hotel is the Adolphus.

Speakers appearing before this Dallas convention include the following:

Walter Cronkite, news analyst and commentator, Columbia Broadcasting System.

Frederick Close, vice-president in charge of sales, Aluminum Company of America.

Harold Webster, president, National Electrical Contractors Association.

Maurice L. Lipsich, vice-president-director of sales, Dormeyer Corp.

George W. Provost, Jr., president, National Association of Electrical Distributors.

Robert L. Thornton, mayor, City of Dallas.

In addition to these, and other speakers yet to be announced, there will also be a special presentation on the services and programs of NAED as well as the popular NAED convention feature, "Let's Swap Ideas," in which members of the association report on management ideas that have proved profitable and successful for their businesses.

The NAED convention officially starts on Saturday, April 30th, with the scheduling of commodity committee meetings throughout the full day, starting at 9:00 a.m. Convention registration also starts on that day, from 1:00 to 5:00 p.m. at the Adolphus Hotel. Convention registration continues on Sunday, Monday and Tuesday—May 1 to 3—at the Memorial Auditorium.

There is no registration fee for NAED members or for those manufacturers holding conference booths. There is a registration fee of $50 each for all others attending this Dallas convention.

The conference booth center will be open from 2:00 to 5:00 p.m. on Sunday and Monday, and again on Tuesday, from 1:00 to 4:00 p.m. Advance registrations for conference booths to date indicate a capacity turnout for this popular and practical convention feature.

The general convention sessions, open to both members and guests, will be held at the Memorial Auditorium on Monday and Tuesday mornings, from 9:30 to 12:00 noon. There will be a convention session for members only on Wednesday, beginning at 9:30 a.m.

An added feature of the Dallas convention—to celebrate the fact that this is the first time in the history of the association that a national NAED convention has been held in the State of Texas—will be a rodeo which has been promoted and produced by the NAED members in the Dallas-Fort Worth area. This rodeo will take place on Tuesday, May 3rd, starting at 9:00 p.m. at Fair Park, Dallas.

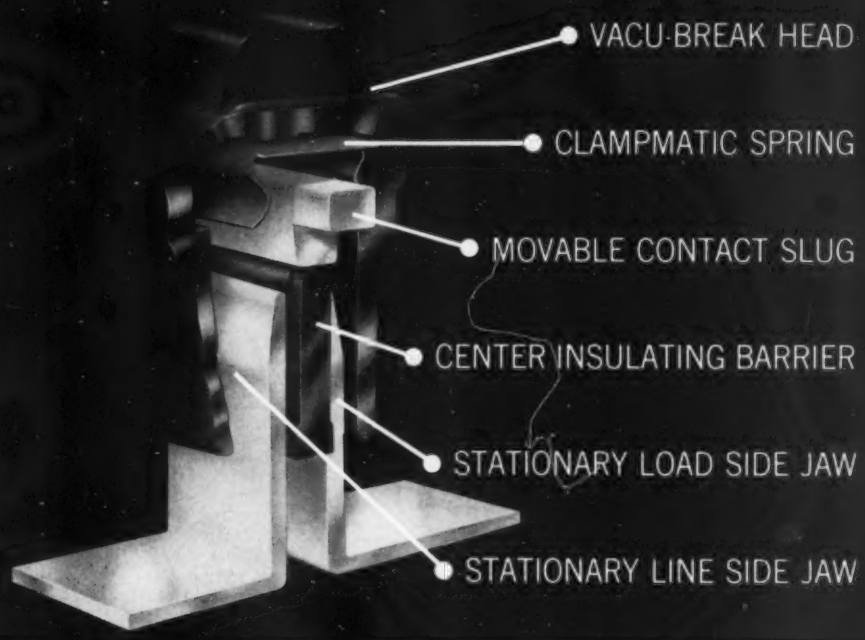
Room reservations for the NAED Dallas convention are handled by the NAED Housing Bureau, c/o Convention and Visitors Bureau, 1101 Commerce Street, Dallas, Texas.

Lighting and heating subject of conference

THE THREE-DAY annual sales conference conducted each year by the commercial sales engineering department of the Georgia Power Co., Atlanta, has proved to be a boon not only to power company sales representatives, but also to consulting engineers, electrical manufacturers' representatives, and others especially interested in the promotion of lighting, electric heating, air conditioning, and commercial electric cooking.

Among participants in the program presented at Georgia Power Company's annual commercial engineering sales conference were Joe Browder, left, assistant to vice-president in charge of sales, and Johnnie E. Sweatte, manager commercial engineering sales who presided over the conference.

Left to right, J. W. Elrod, commercial sales engineer, Atlanta, who discussed the company's 1960 lighting program; Jerry Fudge, Columbus Division commercial sales manager, and C. R. Minors, Atlanta Division commercial sales manager, who participated in the electric heating portion of the program.



THE INSIDE STORY...

Why switches last longer with clamped pressure contact and Vacu-Break arc control

This BullDog Vacu-Break® Switch Head is the reason why Vacu-Break switches stay in action longer.

See how the unique Clampmatic® spring clamps the contact slug firmly between the line and load jaws . . . provides a virtual bolt-tight connection! This clamped pressure contact prevents overheating while in the "on" position—and as the switch moves to "off," the spring speeds the break. Both features mean longer switch life for your customers.

Equally important to longer switch life is the action of the Vacu-Break head. Arc chambers enclose the switching contacts. When contacts are broken under load, arcs are smothered quickly. Pitting and burning are cut to the absolute minimum, thereby minimizing maintenance.

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Michigan. In Canada: 80 Clayson Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N. Y.

For Safety's Sake Buy Vacu-Break

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY

Consult the following Southern representatives:

Wilson Electrical Equipment Co.
3210 Garrow St., P. O. Box 1725
Houston, Texas

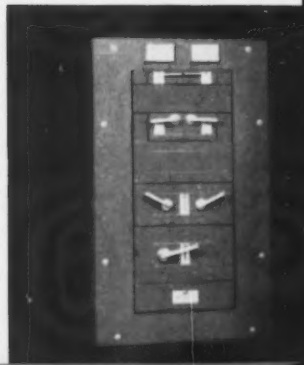
Wilson Electrical Equipment Co.
101 E. Maple Street
San Antonio, Texas

Standard Electric Mfg. Company
2401 Federal St., P. O. Box 1138
Dallas 1, Texas

Walker Electrical Co., Inc.
125 Bennett St., N. W., P. O. Box 2308,
Station D,
Atlanta, Georgia

KEEP PACE WITH ELECTRICITY

Vacu-Break switch units with clamped pressure contacts are available in BullDog Safety Switches, Switchboards, Vacu-Break Power Panels and Bus Plugs. They cost no more and give your customers the maximum in safety and performance. See your BullDog distributor.



The 1960 sales conference, conducted recently, was opened by C. M. Wallace, Jr., vice-president in charge of sales, Georgia Power Co. Johnnie E. Sweatte, manager of commercial sales engineering, who presided over the conference, then introduced specialists of the department for brief discussions of their 1960 programs. Ralph Layfield discussed the commercial cooking program, Harry Yopp discussed heating and air-conditioning, and Jason W. Elrod, the lighting program.

The remainder of the first day's session was devoted to presentations by various electrical cooking equipment manufacturers.

The second day of the conference was devoted entirely to the subject of electric heating and featured talks by C. R. Minors, Jerry Fudge, and W. A. Davis, all of Georgia Power Co.; Walter Church, Edward L. Wiegand Co.; and John Borum, of Lazenby and Borum, consulting engineers. The session was concluded with ten-minute presentations by 24 manufacturers of electric space heating equipment.

The last day of the conference was devoted entirely to the subject of lighting. Special features of this session included an address on the aims and activities of the Illuminating Engineering Society by Joe Browder, sales manager of Georgia Power Company and president of the IES, and a panel session on Code problems relating to lighting. Walter Smith, Georgia Power Co., Augusta, served as moderator of the Code discussion session. Panel members included Dewey Johnson, superintendent of electrical affairs, City of Atlanta; D. C. May, consulting engineer, Atlanta; and C. R. Minors, Atlanta, and R. A. McMichael, Valdosta, both of Georgia Power Co.

Others who addressed the lighting session included Eric Church, vice-president, Lighting Products, Inc.; James F. Whitehead, vice-president, Day-Brite Lighting, Inc.; Jack Burns, General Electric Co.; and Freeman O'Neal, Georgia Power Co.

Housepower inquiry surveys home power

THE AVERAGE cost for home modernization in 1958 is $196 according to a recent Housepower survey just released by the Edison Electric Institute's "Live Better Electrically" program.

The 6-page questionaire of Housepower activities in 1958 was sent to 227 companies, and replies were received from 104 companies representing more than thirty million customers or nearly two-thirds of the electric customers in the U S.

At least 114,000 rewiring jobs resulted from the Housepower promotional program sponsored by the institute, the trade association of investor-owned electric utilities in the country. The modernization of wiring systems of existing homes covered 100 amperes or larger service entrances. Only 16,000 of these were financed, it was noted.

Over half the electric light and power companies covered in the survey promote local adequate wiring programs.

Thirteen thousand electrical contractors participated in this Housepower program. These companies conducted 66 forums, with over 1,100 graduates.

General conclusions from the survey indicate that the Housepower program is a very helpful tool when aggressively promoted at the local level. The respondent utilities claim that Housepower is unique in offering a sales potential for the contractor and wiring equipment manufacturers.

Oklahoma NECA-IBEW leaders honored

THE ELECTRICAL contracting industry honored two of its leaders in Oklahoma City recently with a special program at the Hillcrest Golf and Country Club. Also recognized were 10 new craftsmen completing the four-year apprenticeship.

Tom H. Rushing, manager, Western-Oklahoma Chapter of the National Electrical Contractors Assn., and O. O. Pennington, financial secretary, International Brotherhood of Electrical Workers Union 1141, of Oklahoma City, were presented the U. S. Labor Department's certificate of meritorious service.

Making the presentation was J. P. Mitchell, the department's Bureau of Apprenticeship and Training local representative. Mitchell said the two men were honored for outstanding service in developing and maintaining the highest standards of trade craftsmanship.

Both Rushing and Pennington have served on the joint labor-management administrative committee directing the apprenticeship and training program since 1945.

Rushing, in accepting the honor, said "No other construction trade has experienced the rapid change of materials, methods and technology during the past decade as has the electrical industry. It is only by cooperative effort of both employer and labor that we can insure our industry will be adequately manned by craftsmen competent for both today's and tomorrow's needs."

Pennington viewed the apprenticeship training program as the "lifeline of the industry" and said, "Systematic training assures the employers of quality workmanship, lower production costs, and satisfied customers. It provides opportunity for a profitable career to youth, enabling them to earn while learning. It produces for the community a substantial citizen and adds a skilled worker to the nation's work force, an indispensable factor in national security."

Tom H. Rushing

The 10 new craftsmen awarded apprenticeship completion certificates are: Jack Brooks, Gordon Conklin, Carl Conley, Richard Cotton, Jack Crites, James Foreman, Joe Hayes, Clarence Johnson, C. R. Wilderson and Donald Wright.

Taking part in this ceremony were J. J. Caldwell, executive secretary, state AFL-CIO, and Stanley Hirsch, president, NECA Western-Oklahoma Chapter.

Employers participating in the Oklahoma City program represent a major industry having a gross annual labor payroll in excess of $5 million. Administration is by an eight-man committee equally representative of the employers and the union. Entrance requirements into the apprenticeship program include, in addition to mechanical aptitudes, high school graduation with two years of algebra and a grade of C or better in this course.

Morris McFeeley is employed as full-time training director and coordinator.

Four night classes, with 10 apprentices per class, are currently in progress, with the classes held at the local union hall. Journeyman classes are held in a local high school, with two classes of 15 to 20 each conducted.

O. O. Pennington

ONLY ONE HIGHEST

The highest mountain on the North American continent is Mount McKinley in our 49th State, Alaska. It towers 20,300 feet above sea level and rises higher above the surrounding country than any other mountain in the world. Bronco 66 Certified is first choice for use in these freezing, rocky heights because the high Neoprene content in the jacket gives it unexcelled flexibility in cold weather as well as maximum abrasion resistance.

BRONCO 66 CERTIFIED (67.32%) NEOPRENE

BRONCO Certified 66 NEOPRENE

PORTABLE ELECTRICAL CORD AND CABLE

has the HIGHEST NEOPRENE content in the industry

... at no extra cost. Outer protecting jacket contains not less than 67.32% Neoprene and is so certified by a Registered Professional Engineer. When you buy Bronco 66 Certified, you get the most Neoprene for your money ... hence, maximum protection from oil, acids, alkalis, heat, cold, flame. Always specify Bronco 66 Certified and enjoy the long term economy of top quality.

Self measuring jacket is branded every two feet by a patented Bronco process — U. S. patent No. 2867001. Complete identification is molded into the jacket so it won't rub off.

Buna rubber insulation is built to exceed ASTM D-755 test requirement. Jacket and insulation are Synchro-Cured, the exclusive Bronco process of vulcanization, to work as an indefatigable team.

WRITE FOR FREE SAMPLE! → **WESTERN INSULATED WIRE CO.**
Los Angeles 58, California

Bronco Representatives in the South: FLORIDA, John R. Collins & Associates, P. O. Box 26, Tampa 1; GEORGIA, Frank B. Davis, 708 Spring St., N. W., Atlanta 8; KENTUCKY, Fultz & Company, 2621 Valletta Road, Louisville 5; LOUISIANA, Dupont-Wachter Co., 609 Tchoupitoulas, New Orleans 12; NORTH CAROLINA, G. M. Hogshead Co., 201 W. Worthington, Dillworth, Charlotte 3; TENNESSEE, Ross D. Thomas Co., 198 So. Main St., Memphis; TEXAS, Jack Morgan Co., Inc., 1013 Slocum St., Dallas 7; J. O. Bell, Jr., 3110 Eastside Street, Houston 27; VIRGINIA, Lee A. Roach, 5010 New Kent Rd., Richmond 25.

New firm to market distribution equipment

WHEATLAND Electric Products Co., new Pittsburgh-headquartered firm, has recently been formed to market its own line of standard and specially designed electrical products through distributors to electrical contractors and industries.

Formation of the new company, with its wholly owned subsidiary Wheatland Metal Manufacturing Co., was announced jointly by principals R. C. Bennett, Jr., and T. J. Kavanagh, president of the Wheatland Tube Co.

R. C. Bennett, Jr., president of both Wheatland Electric Products Company and its manufacturing subsidiary, is a veteran of the electrical industry. He was formerly vice-president of National Electric Products Corporation and, more recently, head of Bennett Associates, Inc.

R. C. Bennett, Jr.

Wheatland Tube Co., producer of steel pipe and electric-welded tubing for more than a quarter of a century, has general offices in Philadelphia. Plants and operating facilities are at Wheatland, Pa., and Delair, N. J.

The company will begin supplying the trade with Wheatland brand rigid steel conduit, electrical metallic tubing, headerduct and underfloor duct systems, in early 1960. Additional products will be added at a later date.

All products of Wheatland Electric Products Company will be sold nationally through authorized electrical distributors, by appointed sales agents, and a back-up staff of company-employed specialists.

Ted Nemes appointed Kerrigan sales manager

STEPHEN N. KRIST, general manager of Rockwell-Standard Corporation's new subsidiary, Kerrigan Iron Works Co., Nashville, Tenn., announces the appointment of Ted Nemes as sales manager of Kerrigan's Lighting Standard Div.

Mr. Nemes has formerly served with York, Fedders, and Admiral Corp. He was director of merchandising and sales director of the Contract Division for Cory Corp., national sales manager for the Air Conditioning Division of Admiral, and assistant national sales manager for Fedders.

Ted Nemes

NECA Panhandle Chapter elects 1960 officers

OFFICERS for 1960 of the Panhandle Chapter of the National Electrical Contractors Association were installed recently in Amarillo, Texas.

The new officers are Tom M. Brooks, of Brooks Electric Co., Pampa-Amarillo, president; W. E. Pugh, of A-1 Electric Co., Amarillo, vice-president; Jack Poynter of Crown Electric Co., Amarillo, treasurer; C. S. Williams, Jr., of Williams Electric Co., Clarendon, director; and Elmo Duke, of Duke Electric Co., Amarillo, governor.

Earl Potter, of Amarillo Electric Co., Amarillo, was the outgoing president.

The officers were installed by H. E. DeVilliers, of Fort Worth, field representative for NECA.

Westinghouse promotes Total Electrical Home

WESTINGHOUSE ELECTRIC Corporation has announced plans for "the most comprehensive sales assistance program ever offered to the building industry by an electrical manufacturer." The company will spend $3,000,000 during 1960 in a nationwide program to increase public recognition of the Total Electric Home concept, according to Chris J. Witting, vice-president in charge of the company's consumer products group.

The new program is 20 per cent larger than the 1959 Total Electric Home effort and will include a broad "package" of home plans that have been custom-designed for electric living.

The Total Electric Home is one in which electricity is used as the only source of energy to heat and cool the home, entertain the family, prepare and preserve food and, of most importance, to reduce the amount of work that must be done to maintain a home.

Florida NECA chapter elects Walter Engle

WALTER ENGLE, owner of Engle Electric Co., 440 S. Florida Ave., Lakeland, Fla., has been named vice-president of the Florida West Coast Chapter of the National Electrical Contractors Association for 1960. Harold C. Weir, field representative for the national organization made the announcement.

Engle served last year as a director of the chapter, which includes 17 west coast and central Florida counties.

President of the chapter is J. H. Flournoy of St. Petersburg, Fla.

Wachter to head New Orleans group

ARTHUR WACHTER has been elected 1960 president for the New Orleans Electrical Association, it was announced recently. He succeeds retiring president, W. H. Bramblett.

In addition to Mr. Wachter, the following were elected: Chas. J. Sinnott, executive vice-president; Herbert G. Gregory, vice-president wholesalers, utilities, mfgrs.; Charles G. Glueck, vice-president appliances; Z. K. Remy, vice-president electrical contractors; Louis V. Busenlener, vice-president air-conditioning and ventilation; Warren Munch, vice-president radio and television; W. E. Clement, director of publicity; S. A. Cuyler, secretary; and A. M. Brewer, treasurer.

TVA air-conditioning contest begins in May

SOME 80 of the 152 municipal and cooperative distributors of TVA power will participate in the Tennessee Valley Public Power Association's spring and summer air conditioning campaign May 16 through July 16.

The 80 participating power distributors serve approximately 750,000 people from throughout the Tennessee Valley.

With the theme, "Take a Vacation from Heat . . . with Electric Air Conditioning," the campaign will feature the payment of cash bonuses by power distributors to consumers who buy and install air conditioning during the promotion.

According to J. Wiley Bowers, executive secretary of TVPPA, participating power distributors will pay a bonus of $10 on each room cooler purchased and a larger bonus on central units and heat pumps. The program will get extensive advertising

coverage through all media.

This is the second year that TVPPA has sponsored a Valley-wide air conditioning campaign. In last year's program, the 78 power distributors participating reported the sale of about 7,200 room units during the two-month program.

New appointments made at Graybar Electric

R. B. SAYRE, vice-president of the Graybar Electric Co., Inc., recently announced the appointment of Edwin Lex Bacon as general advertising and sales promotion manager; Raymond C. Babcock as advertising manager; and Ralph Sackett, Jr. as sales promotion manager.

Mr. Bacon has been with the company since 1939 in the advertising and sales promotion department at Graybar's New York headquarters, and was made manager of that department in 1958.

Mr. Babcock joined Graybar in 1943 at their general headquarters. He spent two years in Seattle as sales promotion manager, and returned to New York in 1950 as assistant advertising and sales promotion manager.

Mr. Sackett began in 1952 in Graybar's Florida District. He was made sales promotion manager at Tampa in 1956, and was transferred to New York, where he worked on sales programming and training.

Men moving up in the industry

J. DUANE GORMAN and G. Ellis Vest have been recently elected vice-presidents of the Monogahela Power Co.

Both have been associated with the company's executive offices in Fairmount, W. Va. for some time; Mr. Gorman as division coordinator, and Mr. Vest as a special representative to the executive staff. Both have been with the company since 1937.

Mr. Gorman originally started with the company as chief clerk at Webster Springs, while Mr. Vest's first duties were in the treasury and accounting departments.

* * *

W. L. PARCELL has been elected executive vice-president of the Ridge Tool Co., 400 Clark St., Elyria, Ohio. The announcement was made recently by J. A. Frates, president.

* * *

NORMAN C. MACDONALD has been appointed sales manager and James E. Burke assistant sales manager of The Rawlplug Co., Inc., manufacturer of masonry anchors and drills, it was announced by Frederick B. Powers, president.

Mr. Macdonald has been a sales executive of the company since 1955.

MECHANIZE SCREW ANCHOR INSTALLATION

You've got the means... your power hole-digging equipment. Use it to install Chance Screw Anchors in 5 to 8 man-minutes... *from the time the equipment is moved into position until the anchor is ready for the guy.*

Chance Power-Installed Screw Anchors, ranging from 78 to 176 square inches in area, go down fast into all types of soil (except extremely rocky soil). The sharp cutting helix of high-strength structural steel is tapered to minimize earth disturbance. And, hundreds of installations and pull tests prove these anchors hold more with less creep than any anchors of comparable size.

Your present power boring equipment, regardless of type, can be easily adapted to power anchor installations. Add to this equipment... the special wrench shown at right. It transmits torque from the power equipment directly to the specially designed hub on the anchor helix. Wrenches are made to fit all popular makes of earth borers. And, since the anchor rod is not subjected to torque, it only has to be heavy enough to support the guy load. That's a cost-saving factor too.

So, mechanize screw anchor installations. Install Chance Screw Anchors, and get:

Lower installation costs per anchor
Better utilization of expensive equipment
Greater holding power with less creep
Consistent results
Elimination of human variables and error
Less physical effort, better employee relations

Contact your Chance Representative. Now. He'd like to tell you more about mechanized anchor installation, show you test results and help you apply this new technique to save time, cut costs, and improve your anchoring.

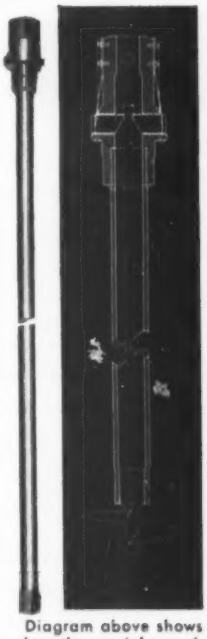
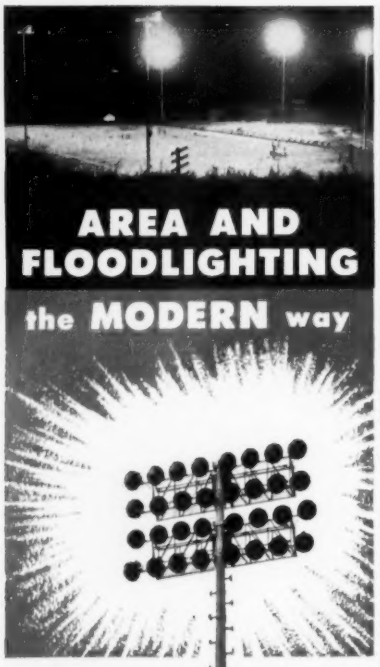


Diagram above shows how the special wrench fits the anchor. Wrenches are made to fit all popular makes of earth-borers.

abc INDUSTRIES

A. B. CHANCE COMPANY
Centralia, Missouri
A. B. Chance Co. of Canada, Ltd., Toronto CA60-4

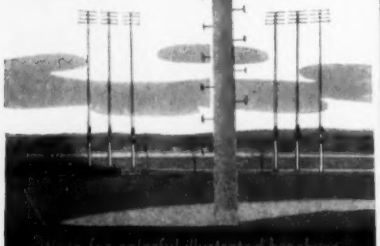


AREA AND FLOODLIGHTING
the MODERN way

TULITO
TAPERED STEEL LIGHTING TUBES

For
- Baseball Diamonds
- Football Fields
- Playgrounds
- Shopping Centers
- Truck Terminals
- Railroad Yards
- Race Tracks
- Radio and TV Towers
- Transmission Power Lines

Engineered for Permanence, Strength and Safety . . .
Designed to accommodate from 2 to 40 lights.
Streamlined to enhance the appearance of any lighted area.



Write for colorful illustrated brochure.

MEYER MACHINE, INC.
P. O. Box 131
RED WING, MINNESOTA

R. P. BRIDGES has been named chief engineer, interrupting equipment, at the Hubbard and Company electrical research laboratory in McCook, Ill.

He will be responsible for the design and development of fuse cutouts and associated equipment. Bridges has spent approximately ten years in the design of electrical apparatus.

* * *

A. J. HILL has been named sales manager at General Electric's Medium Transformer Department, R. B. Ames, marketing manager, announced recently. Mr. Hill will assume his new position at Rome, Ga.

Mr. Hill was formerly manager at General Electric's Columbia, S. C. office of User Industry Sales, having held that position since 1956.

* * *

HENRY B. ROACH, 2708 N.W. 56th St., Oklahoma City, Okla., recently became advertising and publicity manager of the Oklahoma Gas and Electric Company, replacing Paul Hoheisel who retired recently.

A 34-year OG&E veteran, Mr. Roach began his company service as

Henry B. Roach

superintendent's clerk in his home town of Ada, Okla. He worked in the operating and engineering departments in Ardmore and Oklahoma City and he helped organize the company's safety and training program, working as training supervisor until 1949 when he was transferred to the advertising and publicity department as assistant manager.

* * *

WILLIAM E. FARRAGHER, Jr. has been named advertising manager of the Youngstown Sheet and Tube Company at the firm's general offices in Youngstown, Ohio. His promotion from assistant advertising manager, a position he has held since joining the company in 1957, was announced by M. H. Watkins, vice-president of sales.

* * *

NEW KEY assignments in the operating division of the Oklahoma Gas and Electric Company have been handed to three company members.

Wayne A. Parker, a 27-year OG&E veteran, who was formerly Western Division superintendent, has moved into the Construction Department as assistant superintendent of construction.

Mr. Parker has been replaced as division superintendent by Haskell E. Carpenter, supervisor of lines and assistant superintendent of transmission and distribution. Roy Lappin, formerly Western Division engineer, has moved to the Transmission and Distribution Department as supervisor of lines.

* * *

CHARLES B. VAUGHN has been appointed manager of marketing of the Insulator Department, General Elec-

Charles B. Vaughn

tric Co., Baltimore, Md. He succeeds Mr. G. A. Goddard, who has recently retired.

Mr. Vaughn was manager of sales before assuming his present position.

* * *

R. S. EDWARDS, JR. has been appointed sales manager for Edwards Company, Inc., producer of electrical control, communication and protection equipment, it was announced recently by A. L. Kempton, marketing vice-president.

In his new assignment, Mr. Edwards will be responsible for sales of the more than 2,500 industrial, commercial and technical products manufactured by the company.

R. S. Edwards, Jr.

DIAMOND
PRODUCT INDEX

DTX® Non-Metallic Sheathed Cable

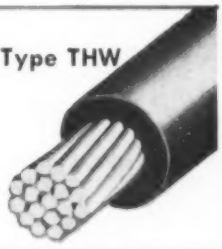
It's the WHITE wire. Non-sticking, smooth and easy to pull, DTX will not flake off. Moisture and flame resistant, it is clean to handle and strips easily.

Diamond for years has concentrated on this "Basic Line" of wire and cable products . . . mixing them thoroughly with quality and prompt delivery. And remember, one source Diamond buying saves ordering time, eliminates error . . . increases your profits.

Heavy Duty Portable Cords

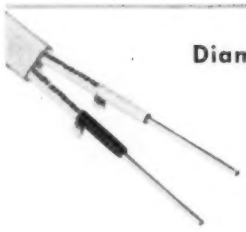
Available in Red-D-Prene (red or black neoprene jacket) oil, heat and flame resistant; Black Diamond (black rubber) for general purpose use; and Signal Yellow (yellow thermoplastic) for all locations where heat is no problem.

600 V Building Wire Type THW



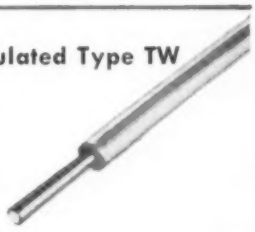
New UL listed Thermoplastic building wire for 75° wet or dry application. Small diameter, slick silicone finish. Standard colors in solid and stranded . . . sizes 14 AWG through 4/0.

Diamond DUF® Type UF



Thermoplastic insulated and jacketed non-metallic sheathed cable. Retards flame and has excellent resistance to moisture, corrosion, fungus, abrasion. UL listed.

Thermoplastic Insulated Type TW



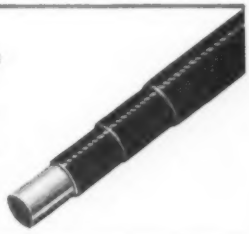
Diamond DTW is the small diameter building wire that is flame and moisture resistant. Eight permanent colors. Small size allows more circuits in existing conduits. Sizes 14 thru 4/0.

Type SE Service Entrance Cable

(Armored and Unarmored—Copper or Aluminum)

May be used without conduit from pole to building and down side of building in places not subject to mechanical injury. UL listed. Neoprene Aluminum SE also available.

Weatherproof Wire



Triple braid weatherproof covering can be relied upon to meet severe climatic conditions. Available also with neoprene or polyethlyene insulation. Comes in solid and stranded, full range of sizes.

Coiled Heater Cord Set

It's new, convenient, safer to use. Non-tangling six-foot cord retracts to 18 inches. Can be used on any heat-type appliances.

Range Cord Sets

Three wire set is 36" long. Rubber molded cap, rubber jacketed cable, steel strain relief. UL listed.

Bare Copper Wire

Soft drawn bare copper wire is available in a complete range of sizes, solid or 7 stranded.

ACT Armored Cable & Flexible Steel Conduit

Suitable for general wiring in non-fire proof structures. Two, three, four conductor.

Trade Mark

DIAMOND
WIRE and CABLE Company
Sycamore, Illinois

WAREHOUSES: Pittsburgh • Cleveland • Minneapolis • Denver • Dallas • Atlanta

Mr. Edwards has spent more than 12 years with the company, beginning his career as a sales trainee. He was named central regional manager in 1956, with responsibility for sales in 11 mid-western states.

* * *

THE APPOINTMENT of Henry J. Chanon as manager of the General Electric Company's Carolinas Sales District of the Large Lamp Department was announced recently by D. B. Clark, manager of the Southern Sales Region of the department. He will make his headquarters at Charlotte, N. C.

In his new position, Mr. Chanon will be responsible for the sale of lamps for general lighting of homes, commerce and industry in both North and South Carolina.

* * *

LOUIS E. NEWMAN, president of Smithcraft Corp., Chelsea, Mass., announces the appointment of George T. Wood as vice-president of marketing, and of Park R. Hoyt as vice-president of manufacturing.

Wood joined Smithcraft in 1957 as manager of marketing. He was formerly sales manager for the Midwestern Division of the Lewyt Corporation and held sales management positions with the Graybar Electric Company in Tampa, Jacksonville and Atlanta. He is a native of Louisville, Kentucky, a graduate of Washington and Lee University.

Park Hoyt joined Smithcraft in 1956 as chief industrial engineer. He is a former management consultant with the Boston firm of Rath and Strong.

Manufacturers appoint new representatives

THE APPOINTMENT of two new sales representatives for Metalcraft Products Co., Inc. has been announced by Nathan Bloom, president of the company.

Robert J. Kuzell, of Kuzell and Co.,

Dates ahead

1st National Electric House Heating Exposition, Sherman Hotel, Chicago, Ill., March 21-23, 1960.

Southeastern Electric Exchange, Annual Conference, Boca Raton Hotel and Club, Boca Raton, Fla., March 21-23, 1960.

Alabama Electrical and Electronic Exposition, Birmingham City Auditorium, Birmingham, Ala., March 21-23, 1960.

IAEI, Mississippi Chapter, King Edward Hotel, Jackson, Miss., March 28-29, 1960.

IAEI, Virginia Chapter, Mariner Hotel, Virginia Beach, Va., April 4-5, 1960.

AIEE, South West District, Annual Meeting, Shamrock Hilton Hotel, Houston, Texas, April 4-6, 1960.

Southeastern Electric Exchange, Engineering and Operation Section Conference, Roosevelt Hotel, New Orleans, La., Apr. 7-8, 1960.

Protective Relay Conference, Texas A & M College, College Station, Tex., April 11-13, 1960.

IAEI, Ellis Cannady Chapter, Carolina Hotel, Raleigh, N. C., April 12-13, 1960.

Missouri Valley Electric Association, Engineering Conference, President Hotel and Municipal Auditorium, Kansas City, Mo., Apr. 20-22, 1960.

Illuminating Engineering Society, South Central—Southeastern Regional Conference, Hotel Peabody, Memphis, Tenn., April 21-22, 1960.

Illuminating Engineering Society, Southwestern Regional Conference, Robert Driscoll Hotel, Corpus Christi, Texas, April 25-26, 1960.

IAEI, Alabama Chapter, Admiral Semmes Hotel, Mobile, Ala., April 25-26, 1960.

National Association of Electrical Distributors, Annual Convention, Adolphus Hotel, May 1-4, 1960.

IAEI, Tennessee Chapter, Andrew Jackson Hotel, Nashville, Tenn., May 2-3, 1960.

Protective Relaying Conference, Georgia Institute of Technology, Atlanta, Ga., May 5-6, 1960.

Southeastern Electric Exchange, Heat Pump Task Force Committee Meeting, King Edward Hotel, Beaumont, Texas, May 5-6, 1960.

IAEI, Florida Chapter, George Washington Hotel, West Palm Beach, Fla., May 5-7, 1960.

IAEI, Texas-Louisiana Joint Meeting, Five Chapters, Hotel Marshall, Marshall, Texas, May 6-7, 1960.

IAEI, Georgia-South Carolina Chapters, Joint Meeting, De-Soto Hotel, Savannah, Ga., May 9-10, 1960.

Southeastern Electric Exchange, Industrial Sales Power Conference, Battery Park Hotel, Asheville, N. C., June 2-3, 1960.

National Rural Electric Cooperative Assn., Region I, Annual Meeting, Commander Hotel, Ocean City, Md., Sept. 8-9, 1960.

Illuminating Engineering Society, National Technical Conference, Penn-Sheraton Hotel, Pittsburgh, Pa., Sept. 11-16 1960.

National Rural Electric Cooperative Assn., Region VIII, Annual Meeting, Hotel Arlington, Hot Springs, Ark., Sept. 12-13, 1960.

National Rural Electric Cooperative Assn., Region II, Annual Meeting, Kentucky Hotel, Louisville, Ky., Sept. 15-16, 1960.

Southeastern Electric Exchange, Accounting Conference, Tides Hotel, St. Petersburg, Fla., Sept., 29-30, 1960.

American Institute of Electrical Engineers, Fall General Meeting, Chicago, Ill., Oct. 9-14, 1960.

National Rural Electric Cooperative Assn., Region II, Annual Meeting, Henry Grady Hotel, Atlanta, Ga., Oct. 10-11, 1960.

National Rural Electric Cooperative Assn., Region IV, Annual Meeting, Stonewall Jackson Hotel, Clarksburg, W. Va., Oct. 13-14, 1960.

National Rural Electric Cooperative Assn., Region X, Annual Meeting, Baker Hotel, Dallas, Texas, Oct. 17-18, 1960.

IAEI, Southern Section, Rice Hotel, Houston, Texas, Oct. 17-19, 1960.

Southeastern Electric Exchange, Engineering and Operation Section Conference, Shoreham Hotel, Washington, D. C., Oct. 20-21, 1960.

Southeastern Electric Exchange, Sales Conference, Henry Grady Hotel, Atlanta, Ga., Nov. 16-18, 1960.

will serve as the representative in Georgia, Alabama, and South Carolina, with an office being at 2489 Midway Rd., Decatur, Ga.

Charles C. Laney, of the Charles C. Laney Agency, will cover the eastern Virginia and North Carolina territories. His address will be Box 142 Rt. 9, Richmond 25, Va.

* * *

APPOINTMENTS of a new chief industrial engineer and of a new lighting representative have been announced recently for the Virden Lighting, a division of John C. Virden Co.

John J. Gutwald, S. Frontenac Dr., Warrensville Heights, Ohio, has been named chief industrial engineer for the lighting division; while John C. Dannemiller, Reeds Dr., Overland Park, Kans., has been appointed lighting representative in the Kansas and western Missouri areas.

* * *

JIM HASH & Co., electrical manufacturers agents with headquarters at 38 Jomandowa Lane, Knoxville, Tenn., has been appointed representative for the Tennessee area for the

Jim Hash

Thiel Tool and Engineering Co., Inc. of St. Louis, Mo., manufacturer of cable clamps and staples, transformer hangers, and other items used by the electrical construction industry.

* * *

SLATER ELECTRIC and Manufacturing Co., Long Island, N. Y., has announced the appointment of J. A. "Gus" Henderson, 6919 Deanne St., New Orleans 26, La., as their agent covering the Louisiana and Mississippi territories.

* * *

DOSSERT Manufacturing Corp., Brooklyn, N. Y., announces the appointment of two Southern representatives. Hopper & McCoy, Atlanta, Ga., will cover Georgia, Alabama, Tennessee, northwest Florida, and western South Carolina; while Ray Green, of the Barber Ayers Co., Greensboro, N. C., will represent Dossert in Virginia.

John C. Moore

REORGANIZATION of its sales force in the South for distribution of Bermico fiber pipe and conduit from its new Birmingham, Ala., plant was recently announced by Robert E. Cross, sales manager of Brown Company's Bermico Div.

In general charge of the Southern territory as regional sales manager will be John C. Moore, with head-

Arthur LeClair

quarters in Birmingham, Ala. Arthur LeClair, of Jacksonville, Fla., will act as sales representative for the states of Georgia, South Carolina and Florida. The Arkansas, Louisiana, Oklahoma, and Texas sales territory will be handled by William E. Welter of Dallas, Texas.

* * *

THE APPOINTMENT of D. R. Ingman, 1261 Chattahoochee Ave., N. W., Atlanta 18, Ga., as new lighting en-

D. R. Ingman

gineer for Line Material Industries was recently announced by R. C. Hunt, South Atlantic regional manager. Mr. Ingman will work with the company's field engineers in solving customer outdoor lighting problems.

* * *

RICHARD Kingston has been appointed Southern regional engineer by Edwards Co., Inc., producer of electrical control communications and protection equipment, it was an-

Richard Kingston

nounced recently by R. L. Kempton, marketing vice president. He will be stationed at Edwards' Southern regional office in Atlanta, Ga.

* * *

SAMUEL H. WILSON has been named manager of the new Tampa, Fla., district sales office of I-T-E Circuit Breaker Co., Philadelphia. He will

Samuel H. Wilson

handle northern Florida sales of the company's equipment used for control and protection of electrical power distribution for residential, commercial and utility applications.

* * *

APPOINTMENT of two new sales representatives to handle Southern and Southwestern sales for Automatic Control Company was made recently.

Livingston Machinery Sales, Inc. will now represent the company in the Dallas, Texas area, while the Henry P. Thompson Company will

P&S TURNLOK

Built to Take It

P&S TURNLOK wiring devices are designed to give trouble-free service no matter how tough the going gets. TURNLOK devices are available in 10 and 20 Amperes, 2-, 3-, and 4-wire types: receptacles, connectors and caps.

All P&S TURNLOK devices have extra large head binding screws and ample wireways for quick, easy wiring. Armored sections are anchored securely. Cap blades are positioned accurately. Contacts are anchored securely. Fastening screws in connectors are secured in body . . . cannot fall out in wiring. Ratings are plainly visible.

For information about P&S TURNLOK Line, write Dept. ES-36.

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PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK

serve as the company's agency in the Louisville, Kentucky area.

John S. Williams, vice-president of Autocon Industries, Inc., a sales subsidiary of the control firm, made the announcement.

* * *

THE RELIANCE Automatic Lighting Company, Racine, Wis., has announced the appointment of Jim Hash and Company, 38 Jomandowa Lane, Knoxville, Tenn., as new sales representative for the state of Tennessee. The company specialiizes in the manufacture of time switches.

Brief news notes of manufacturers

WILLIAM L. THURMAN, Jr. has been appointed general sales manager of the Sta-Bright Fluorescent Manufacturing Co., Miami, Fla., and Irving D. Bernstein, comptroller, according to an announcement by Nat Furman, president of the company.

The Sta-Bright company has launched a program of expansion of all of its activities and is now entering the lighting field in many states not previously served.

* * *

ELECTROMODE Division of Commercial Controls Corporation has announced a $250,000 expansion program for 1960 which will increase the electric heater manufacturer's production potential by 35 per cent.

Robert E. Pequignot, vice-president and general manager of Electromode, said the major part of the expansion will be embodied in a new centralized packaging and warehouse building which will add almost 20,000 square feet of space to the present 80,000-square-foot plant.

JACK BENFIELD, known to many in the industry as "Mr. Thin Wall," has concluded arrangements with Appleton Electric Company to market his own line of conduit benders.

His latest bender, now called the "Appleton - Benfield," incorporates several important features that make the tool universal for steel or aluminum and for rigid or thin wall. These improved tools are now available through Appleton's franchised distributors.

* * *

DANIELS STANDARDS, INC. has been formed by Gordon E. Daniels and a group of associates to manufacture steel, aluminum and galvanized street lighting standards, traffic signal supports and other items pertaining to public, plant, and safety lighting. They will manufacture both round and octagonal shafts.

The company production plant is located in Humboldt, Tennessee, and is now nearing completion. Production will start immediately upon completion of the plant and first deliveries will be made in April.

* * *

FOUR DEPARTMENT heads have been named in a series of appointments involving administrative and marketing responsibilities for Wheatland Electric Products Co., Pittsburgh, Pa.

J. L. Bauer has been appointed manager of conduit sales and service, and R. C. Huckestein has been made product manager of underfloor raceways for Wheatland. J. J. Dougherty, Jr., has been named eastern sales manager for the firm. T. E. Hoskins has been appointed chief product engineer for Wheatland Metal Manufacturing Co., a wholly owned subsidiary.

Each of the new Wheatland officials was formerly associated with National Electric Products Corporation.

New products

One-tool conduit bender offers versatile uses

THE APPLETON-BENFIELD, a new line of conduit benders, has recently been introduced to the market by the Appleton Electric Company.

The new benders feature a one-tool device for thin wall, rigid steel or rigid aluminum conduit; a degree scale for precise offsets; square outriggers on a hook to stabilize the tool and give the operator solid footing; and a built-in back-pusher for minor degree adjustments when necessary. The new benders also include bold, clear symbols on both sides to encourage precision bending, plus a new "Powr-Jack" booster step that doubles bending leverage and extends the practical hand bending range up through 1¼-inch EMT and 1-inch rigid.

All benders are pre-stressed at the factory and are guaranteed 5 years. An illustrated instruction book also accompanies each tool.

Write P-321 on reply card, pg. 20

Beam clamp flush-mounts conduit in close areas

A NEW FASTENING device, the Junior Beam Clamp, has been developed by The Paine Co., 38 Westgate Rd.,

Addison, Ill., national manufacturer of hanging and fastening devices.

According to Paine officials, the new Junior Beam Clamp solves the problem of securing conduits, switch boxes, pipes, etc., onto "I" beams, ceiling channels, web joists or any type of building framework requiring lightweight, flush-mounted fastening.

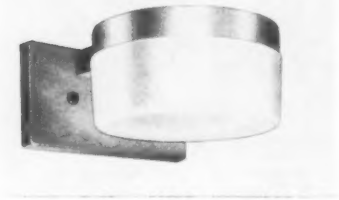
The new clamp fastens in any position easily, quickly and securely, and is designed for use with ¾ inch wide and up channels, ¼ inch and/or "I" beam members. It can also be adapted for a variety of other applications, including the horizontal or vertical holding of electrical boxes needed to feed recessed fixtures; also for hanging a continual row of lighting fixtures in a variety of styles.

Write P-322 on reply card, pg. 20

Aluminum base fixture diffuses porch, hall light

A NEW DIECAST aluminum wall bracket lighting fixture specially designed for use in halls, under overhangs, soffits, and porches is now available from the Prescolite Manufacturing Corp., 2229 Fourth St., Berkeley, Calif.

In a contemporary style, the wall bracket fixture is made with a hand blown, hinged Thermopal enclosing globe, eight inches in diameter. The



globe's construction insures uniform light diffusion and color density.

A unique Type R mounting strap locks the diecast aluminum base in the desired position. Convenience outlets and pin switches are among the accessories Prescolite offers for the unit.

The fixture comes in a variety of finishes, including satin chrome and oyster, chocolate brown, green, black, or synthetic satin brass baked enamel. Its overall dimensions are 9¾ by 4½ inches. Sixty-watt lamps are recommended.

Write P-323 on reply card, pg. 20

Automatic switch transfers to instant emergency power

DELTA-STAR Electric Div., H. K. Porter Co., Inc., 2437 Fulton St., Chicago 12, Ill., has developed a dual cylinder, double throw automatic

Truck Equipment Company Dept. 25
3963 Walnut Street, Denver 5, Colorado

Gentlemen:

I am interested in how Truco can solve my stringing and reconductoring problems. Please send your Tensioning Brochure *today*.

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Pulls and Tensions FOUR Conductors Simultaneously

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Uses ONE Puller and ONE Tensioner to do the Complete Stringing and Reconductoring Job

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Strings or Replaces Conductors Safely, Simply and Efficiently

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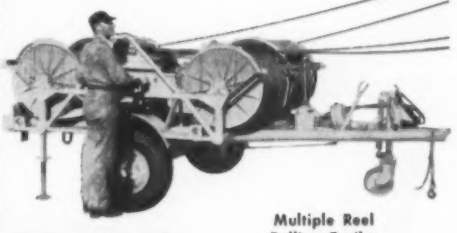


Multiple Reel Pulling Trailer

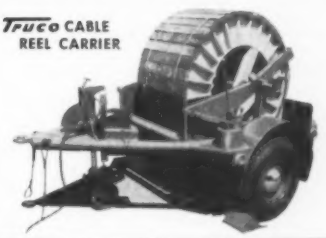
NEW TENSIONING EQUIPMENT

Multiple Reel Stringing Trailer

Complete utility and maintenance hydraulic equipment

Truco AERIAL LADDER

Truco CABLE REEL CARRIER



Truco AERIAL LIFT

Truco HYDRAULIC DERRICK

Write or phone for full details

Truco

Ask for name of nearest distributor

TRUCK Equipment COMPANY

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We have a carefully considered little write - up which is a guaranteed method for you (Mr. Contractor) to lose your shirt! Perhaps you would like to have a copy of it... it's free. Also available is a sure-fire method to keep your shirt on -- and make a profit, too. Take your choice -- or get both -- just fill in the coupon below.

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Gentlemen: Please send me

- ☐ "YOUR SHIRT and how to lose it!"
- ☐ Details about "National Price Service"
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NPS National Price Service
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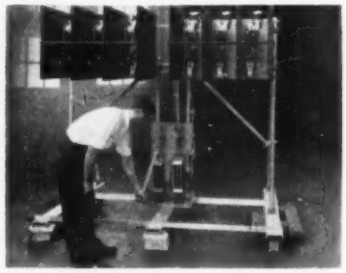
13601 EUCLID AVENUE • CLEVELAND 12, OHIO

switch transfer mechanism, activated by stored energy. Reliable as well as economical, the new mechanism was specially designed for installation in an area encompassing hospitals, freezer storage plants, and other power users for whom an extended service interruption could be disasterous.

The mechanism opens the preferred source disconnect switch and closes



another to instantly transfer to an emergency power source when power failure occurs. The cylinder for the preferred switch is activated by loss of preferred source voltage. A timing device selects from 0 to 30 seconds time delay to allow circuit breakers to operate properly before triggering the preferred cylinder. When the preferred switch is opened, a signal is immediately relayed to the second cylinder to close the emergency switch and cut in the emergency power source without interruption of service. The mechanism offers selectivity so the preferred line may be designated as either of two sources.

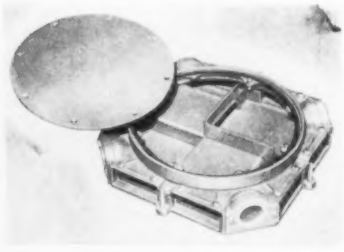
The two three-phase switches are equipped with Powerupters (compact enclosed-type interrupters) and have insulating barriers between the phases.

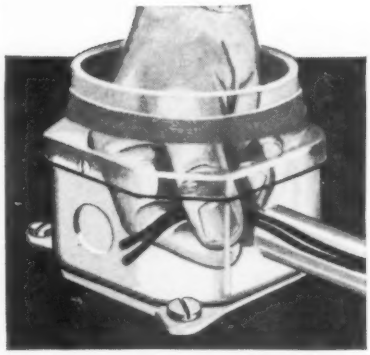
Write P-324 on reply card, pg. 20

Underfloor junction boxes fit into thinner slabs

To MEET today's trend toward thinner slabs, Walker Brothers, P. O. Box 33, Conshohocken, Pa., now offers junction boxes No. 222-2½-1S and No. 3222-2½-1SC, both of which can be installed in concrete slabs of 2½-inches or deeper.

Junction box No. 222-2½-1S accommodates two Walker No. 2 ducts





The "TRU-LEVEL"
Adjustable
Floor Box Is Easy To Install

The #190 "Tru-Level" box is a standard 4 inch octagon, sheet steel box—and is watertight.

Concrete can be poured to very top, also to box-body height only. A second tin lid is provided. The box-body has a 3¼" opening, making it easy to get hand into for conduit attachment or wire-pulling.

A skin tight plastic collar seals out moisture while protecting the adjusting-ring threads and also keep open an avenue for hand to fit down thru concrete.

Adjusting-ring is designed to fit all popular size and style receptacles—you simply clip off plaster ears and drop into place.

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Represented in the South by

CARY CHAPMAN & COMPANY
702 Whitehall St., S.W., Atlanta, Ga.
213 S. Front St., New Orleans 12, La.
1009 South Elm St., Greensboro, S. C.
2516 Eighth Court North, Birmingham, Ala.
301 East 10th Ave., Hialeah, Fla.

F. P. WALTER COMPANY
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V. E. STEPHENS
3523 Dutton Drive, Dallas 11, Texas

ARTHUR H. SWARTZ
5003 Kelso St., Houston 21, Texas

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Fullman
MANUFACTURING COMPANY
1209-1215 JEFFERSON ST.
LATROBE, PENNSYLVANIA

(1¼ x 3⅛-inches) per side, and features removable interior partitioning which eliminates trouble for the contractor, should the direction of the box partition require changing after concrete is poured. Box No. 3222-2½-1SC accommodates three Walker No. 2 ducts per side. Both boxes accommodate 1¼-inch minimum height. Higher rings are available on order.

These boxes feature large handhold openings with 1-inch spacing between ducts and simplified 4-screw leveling, plus a ring and top assembly that can be raised to the final screed line before or after concrete has set, without removing cover plate.

Write P-325 on reply card, pg. 20

Zinc, elastic enamel coat electric metallic conduit

THE YOUNGSTOWN Sheet and Tube Co., Stambaugh Bldg., Youngstown, Ohio, has announced its new Buckeye electric metallic tubing, EMT.

The bright finish EMT is a product of Youngstown's new automated mill and electrolytic galvanizing line

that assures uniform quality and flexibility. The zinc corrosion-resistant coating is protected by an elastic enamel finish applied to both the exterior and interior. The interior coating provides a raceway that makes fishing and pulling easy.

Sizes from one-half to two inches, OD, are available.

Write P-326 on reply card, pg. 20

Test kit keeps tools, testing units together

THE PYRAMID Instrument Corp., 630 Merrick Rd., Lynbrook, Long Island, N. Y., has announced the development of a kit designed to hold an Amprobe Snap-on Volt Ammeter and accessories in one compact case. Ruggedly constructed of genuine cowhide, the kit measures a mere 7½" x 10" x 2½" yet has interior space for not only test instruments but small handtools that are most often used by electricians.

ROYAL ELECTRIC

FIRST CHOICE

among men who know portable cord!

Yes, more electrical contractors and maintenance men specify Royal than any other portable cord in its class! Why? The reason is simple, but important to men with jobs that depend on the quality, safety and durability of the flexible cord they use: every foot of ROYAL cord and cable meets the high-performance standards you need on the job.

Your wholesaler stocks a complete range of Royal types and sizes — rubber, neoprene and plastic jacketed cords, power cables, thermostat cable, lamp and fixture wires, machine tool wires, and heavy-duty "POWR-KORD" extensions. All *made* right, *priced* right, *packaged* right — quick and easy to use!

Next time you order cords, specify ROYAL . . . preferred by electrical men everywhere!

ROYAL ELECTRIC . . . an associate of LTV

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NuRo Company, Houston—Dallas—San Antonio

Koenig ALL-STEEL UTILITY BODIES

LINE-CONSTRUCTION BODY

. . . available in 9' to 14'6" lengths with mechanical or hydraulic winch and derrick, or any other special or custom equipment desired. Compartments can be arranged to your specifications.

SERVICE BODIES

. . . for ½-, ¾-, and 1-ton chassis. Electrically welded into one unit with six waterproof compartments, recessed paddle handles keyed alike and fender skirt protected with die-formed rolled edges. Built for safe, dependable service . . . will outlast several chassis.

3-WAY DUMP BODIES

DUMP to the RIGHT, LEFT and REAR

All-steel welded bodies available in 8' to 11' lengths. The multistage telescopic hoist has a lifting capacity of 25,000 lbs. This is the ideal body for safe dumping under hazardous conditions . . . especially adaptable for windrowing and backfilling.

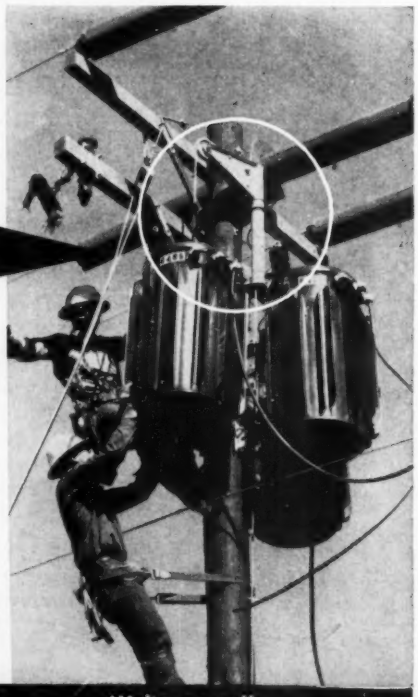
YOU CAN BE SURE OF QUALITY MATERIALS AND WORKMANSHIP WHEN YOU SPECIFY KOENIG PRODUCTS

Write for literature, specific information and name of nearest distributor today.

Koenig IRON WORKS, Inc.

P. O. BOX 7726-B
HOUSTON, TEXAS

Cut costs... Provide greater safety with a MoPeCo Transformer Hoist



- One position base mounting
- Swivel head permits multiple mounting
- Lightweight 2 piece portable unit (42 lbs.)
- Assembles easily at top of pole
- Tested at 3000 lbs. lift on cable
- Uses steel cable or manila rope

Save time with the MoPeCo hoist. You can install 3 transformers in only 30 minutes!

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Available in two models, the Pyramid Test-Master Kit can be used by all electrical men: contractors, plant maintenance, refrigeration, air conditioning, oil heating, and in any field in which quality test devices are used.

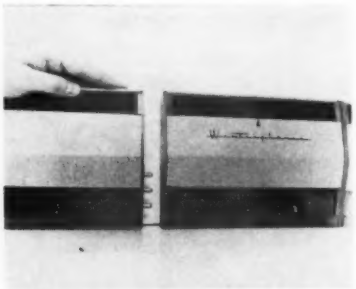
The basic unit in every Test-Master is a model from the Amprobe Rotary Scale series. For example, the TM-33 outfit contains the Amprobe RS-3 Snap-Around Volt-Ammeter-Ohmmeter with five current ranges and three volt ranges.

Write P-327 on reply card, pg. 20

New baseboard heating units feature plug-in connectors

A NEW LINE of baseboard electric heating equipment introduced by the Westinghouse Electric Corp., Box 2099, Pittsburgh, Pa., features the use of modular plug-in sections that cut installation time. Although more compact than previous models, these units provide the same output, 250 watts per linear foot, while the surface is comfortable to touch.

The unique plug-in feature simplifies installation since electrical connections are required only in the control section. Additional sections are installed by "plugging-in" to the control section through a concealed three - pronged connection. This double-male grounded plug provides continuous flow of power to each section. The units are easily fastened to the wall to complete the installation.



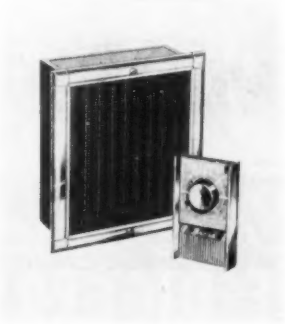
One standard 2-foot length is available because of the flexibility provided by the plug-in feature. The line also includes a new "universal" corner section, providing continuous right angle connection for either an "inside" or "outside" corner. Separate corners were previously necessary.

Each section is equipped with "thermal safety protection." If air flow through the section is blocked, causing the unit to overheat, the section will shut off automatically. It will turn ON again when the unit cools and will stay ON provided the obstacle is removed.

Write P-328 on reply card, pg. 20

Wall thermostat teams with electric heater

A WALL THERMOSTAT teamed with an electric wall heater has been announced by the Broan Manufacturing Co., Inc., P. O. Box 140, Hartford, Wis. The company claims a most sensitive, accurate unit, designed so



that it is fully exposed to room air temperature. Any one-half degree change is immediately "felt" and the operation of the heater is instantaneous. Warming heat can be felt within 10 seconds of the switch-on.

Broan asserts that the new wall thermostat will make a significant difference in maintaining more even room temperatures.

Write P-329 on reply card, pg. 20

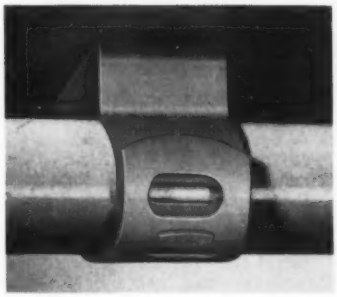
Thermal overload relay gives more protection

REDESIGN of its thermal overload relay (Type 194A) for use in size 6 and larger starters has been announced by Allis-Chalmers Mfg. Co., 938 S. 70th St., Milwaukee 1, Wis.

The precision thermal overload relay with direct mounted heater element compensates for temperature differences to eliminate needless and unnecessary motor stoppages and provides more complete motor overload protection than ordinary relays.

The relay consists of a helical actuating bi-metal, a helical compen-

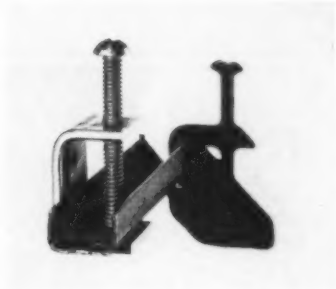
Paine Presents Two Big, New Improvements In Fastening Devices—



PAINE'S ALL-NEW LIBERTY* CONDUIT CLAMP

Designed for hanging and fastening of rigid or thin wall conduit. Easy to install, holds securely. We urge every electrical contractor, electrician, maintenance man to try the new Liberty* Clamp. There is a current rush for orders, so please get yours in early so we can assure our usual prompt delivery.

- One-piece unit has unique locking device.
- Eliminates need for nuts and bolts.
- Only standard electrician's pliers, screw driver needed.
- Provides extra strong, secure hold.
- No sharp edges or extended protrusions; makes flat, smooth fastener.
- Made from rugged, yet pliable, material.
- Saves the user waste, time, aggravation.



PAINE'S NEW, VERSATILE JUNIOR BEAM CLAMP

Fastens in any position — easily, quickly, securely. Use for securing conduits, switch-boxes, pipe, etc. onto "I" beams, ceiling channels, web joists or any type of building framework requiring lightweight, flush-mounted fastening. Try it!

- Designed for use with 1" wide and up channels, 1/4" and up "U" shaped or "I" beam members.
- Adapts to the horizontal or vertical holding of electrical boxes for feeding recessed fixtures.
- Also effective for hanging a continual row of lighting fixtures in many styles.
- Assures a hidden method of holding conduit pipe, cable above false ceilings.
- Mounts flush against channel, makes conduit runs neater, more even, stronger.
- Works ideally with any Paine conduit clamp.

* Patent Applied For And Pending, Serial Number 812671

the best craftsmen always take PAINE'S

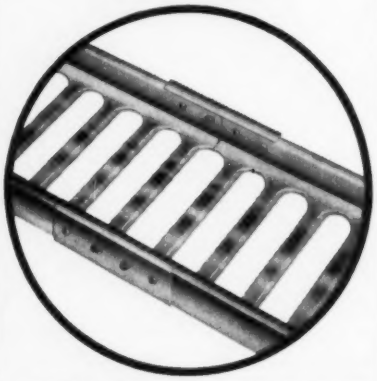
Spring Wing Toggle Bolts	Conduit Clamps	Star Drills
Expansion Anchors	Pipe Hooks and Straps	Malleable Shields
"Sudden Depth" Drills	Hanger Iron, perforated	Special Hanging and
Wood Screw Anchors	Expansion Shells	Fastening Devices

THE PAINE COMPANY 20 Westgate Road, Addison, Illinois

Save Time, Money Speed Installations with . . .

P-W

CABLE SUPPORTING SYSTEMS



P-W's TYPE "E" (PUNCHED BOTTOM) TRAYS—FOR POWER AND CONTROL CABLES AND INSTRUMENT TUBING—ALTHO LESS EXPENSIVE, ARE STRONGER, VERSATILE AND SUPERIOR. CONTROL CABLE CAN BE DROPPED OUT ANYWHERE.

Engineers, Contractors and Installers look for QUALITY, LONG LIFE, AND LABOR SAVINGS in their supports. That's why more and more users are turning to P-W. Among our outstanding improvements are: CONNECTIONS that are quick and easy to install—PRE-CUT SYSTEMS saving installation time—EXTENSION CONNECTORS eliminating field cutting to complete runs — ADJUSTABLE HORIZONTAL and RISER CONNECTORS to go over, under or around pipes, trusses, columns, etc. — BUILT-IN ADJUSTABLE DROP-OUT SECTIONS eliminate cutting out bottom of tray — STRAIGHT SECTIONS available in lengths up to 16' (33⅓% less connectors and less installation time over 12' lengths).

P-W SUPPORTS are available in hot dip galvanized steel or aluminum, in LADDER, EXPANDED METAL and SOLID TRAYS in addition to Type "E". All systems are interchangeable. Write for Catalog 858-A.

For the utmost in service, contact the appropriate Representative in your territory or P-W direct, regarding inquiries and placing orders.

P-W INDUSTRIES
11200 Roosevelt Blvd.
Philadelphia 15, Pa.

sating bi-metal, and a heater coil which completely surrounds the actuating bi-metal.

Current through the heater—equal to or proportional to the line current—causes a rotary motion of the main shaft and its cam due to different rates of thermal expansion of the constituent metals of the bi-metallic element.

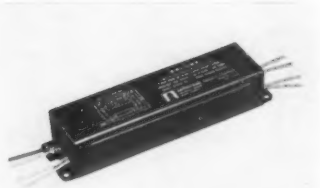
Write P-330 on reply card, pg. 20

Fluorescent ballast design eliminates compound leakage

A NEW CONCEPT in fluorescent ballast design, a solid fill ballast with case, core and coil permanently bonded into a single unit, has been developed and introduced by Jefferson Electric Co., 910 S. 25th St., Bellwood, Ill.

The new "Dri-Lok" ballast eliminates all possibility of compound leakage, and contains an unusual stable thermo-setting material that will not react or combine chemically with any other material in the ballast. It cannot ever, under any operating condition, soften or liquefy, according to Jefferson officials.

The new material has high dielectric strength and according to the company, danger of parts working loose or shorting is eliminated by the



bonding of all ballast components into an integral unit.

An extended life for the new ballast is also claimed because of its effective heat-dissipating qualities. The extreme heat conductivity of its thermo-setting material, coupled with the voidless filling and bonding of the ballast, result in cooler operation. The "locked-in" design of the Dri-Lok also reduces ballast hum to a new low.

Write P-331 on reply card, pg. 20

NEMA Size 4 starter reduced 33% in size

A COMPACT new NEMA Size 4 starter which is 33 per cent smaller than most Size 4's has been announced by Square D Co., 4041 North Richards St., Milwaukee 12, Wis. The

It took 29 yrs. research to make

JAQUES Hydraulic HOLE DIGGERS

Fastest, Strongest, Safest most economical!

Jaques TJ-254 digging at 30 degree angle. Operates at up to 45 degrees.

Time-and-money-saving features of Jaques All-Hydraulic Hole Diggers took 29 years to develop. Rugged, versatile Jaques TJ-254 mounts on standard trucks, drills holes up to 48" diameter, to 25' depth, in hardest soil or rock — FASTER, CHEAPER, EASIER than competitive machines! Fewer moving parts insures ***minimum down-time, maintenance, operating costs.*** Shock-resistant device relieves strain in rock digging. Simple to operate with only 3 primary adjustments. FREE DEMONSTRATION WILL PROVE THESE CLAIMS!!

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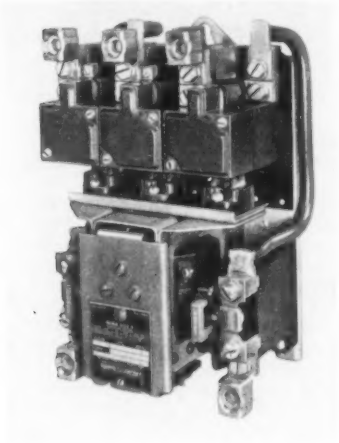
TEXOMA ENTERPRISES, INC.
HIGHWAY 75 NORTH • SHERMAN, TEXAS

new starter retains the long-life electrical and mechanical characteristics of the previous design. Dimensions are 12⅜ by 8¼ by 6-5/32 inches.



The new starter features trip-free melting alloy overload relays with unit-construction thermal units, or adjustable bimetallic overload relays with hand and automatic reset. Up to four double-circuit interlocks may be added.

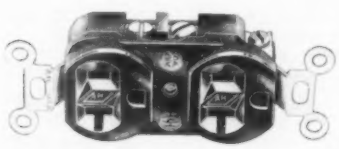
Molded coils plus contact blocks molded of inorganic, non-carbon tracking material provide extra electrical life. Large contact tips of special silver alloy also contribute to long life as well as easy inspection and maintenance.

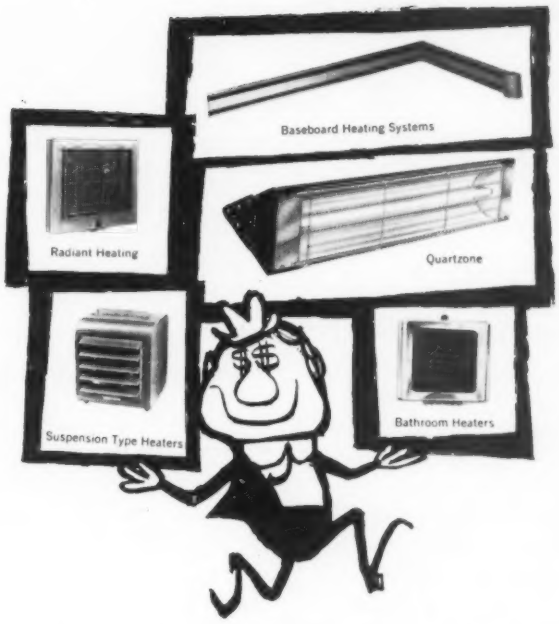
Write P-332 on reply card, pg. 20

Grounding receptacle, cap meet new Code requirements

THE ARROW-HART & Hegeman Electric Co., 103 Hawthorn St., of Hartford 6, Conn., announces the availability of new 20 ampere, 125 volt duplex grounding receptacles and caps. Supplied in 2 pole, 3 wire grounding types, they are offered to meet the rapidly growing need for 20 ampere, 125 volt circuits in homes and office buildings to handle the ever-increasing number of heavier rated appliances, office machines, and other electrical equipment.

These new receptacles and caps are of H&H Specification Grade quality. They are designed for use by electrical contractors, electrical mainte-





It's easy to make a good profit in electric heating when you sell ELECTROMODE

The price is right . . . the mark-up is good . . . installation is quick and easy . . . service calls are virtually non-existent . . . and the name is one that commands respect.

Only Electromode offers you a complete line of electric heating equipment . . . for the home, for the office and shop, for industry.

With Electromode you can offer your customers forced-air heating for a bathroom or a warehouse...complete, baseboard heating systems . . . radiant heating . . . explosion-proof heaters . . . even infrared heating for outdoor locations.

A High Wattage Promotion Campaign

To help you sell profitable home heating installations, Electromode offers a complete promotion package that's guaranteed to make the electrical heating system you install the talk of the town . . . a complete package which you can offer to the building contractor . . . to win you the heating contract.

Electromode Means Quality

Electromode is a name that has stood for the best in electrical heating since 1929 . . . because Electromode has manufactured *only* electrical heating equipment.

The Electromode Safety Grid is a feature that is known and recognized wherever electrical heating equipment is sold. Because all current-carrying, heat-emitting wires are buried in the solid cast-aluminum grid the heating element can't shock, burn or cause a fire.

Visit the ELECTROMODE Exhibit at the NEMA Show, March 21-23— Hotel Sherman, Chicago, Booth No. 101

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ROCHESTER 3, NEW YORK

*Trademark

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...DISTRIBUTION ENGINEER

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"*Service continuity* to keep our customers satisfied . . . *low maintenance costs* . . . in short, *greater dependability* and *savings*."

Everywhere, Distribution Engineers . . . *the men technically responsible for keeping customer lines in service* . . . acclaim Fanner Superforms.

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"PROTECTIVE TWIST"

ARMOR RODS...
Protect long-span T&D lines at supports

LINEGUARDS...
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PATCH RODS...
Repair damaged conductors

TAP ARMOR...
Protects conductor at tapping points

FANNGRIPS...
For dead-ending strands and conductors

FANNSPLICES...
Join two ends of conductor wire

PLASTIC PRODUCTS...
For conductor surface protection

FANNER
The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

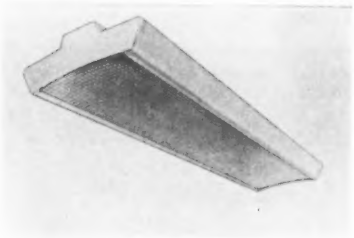
nance men and all others who must comply with the revised National Electrical Code. They are approved for use as stated in Article 210, Section 210-21 of the 1959 National Electrical Code.

Of sturdy construction, and equipped with two circuit break-off fins, the new grounding receptacles are offered in brown bakelite, ivorylite, or with weatherproof plates, with or without padlock. Design includes a red strap for 20 ampere identification and double grounding terminals. The caps are made of rubber or armor over rubber. Both receptacles and caps are listed as standard by Underwriters' Laboratories.

Write P-333 on reply card, pg. 20

Fluorescent luminaire uses plastic construction

A NEW, EXTRA STRONG, all plastic lighting fixture from the Edwin F. Guth Co., 2615 Washington Blvd., St. Louis 3, Mo., the Guth Gateway, incorporates a new concept in fixture



construction. Plastic is basic, not a wrap-a-round. The concave Gratelite bottoms hinge separately. The units are available either with concave Gratelite Louver-Diffuser, the ⅜-inch open cubicle plastic, or concave Prismoid Gratelite, the reversible prismatic louver-lens.

Gateway features tubular designed plastic side wings for added strength, lower side brightnesses, plus better efficiency, since the inner side wall acts as a reflector. Plastic side wing ends are capped to minimize maintenance. The side wings are continuous one-piece plastic sections.

Write P-334 on reply card, pg. 20

Technical books

for the electrical man

Estimating man-hours

"Estimator's Electrical Man-Hour Manual," by John S. Page and Jim G. Nation. Published by Gulf Publishing Co., P. O. Box 2608, Houston 1, Texas, 219 pages, hard cover, spiral bound, $10.00.

"Estimator's Electrical Man-Hour Manual" provides an accurate method of estimating direct labor for complete electrical installation for any given system or plant. It points out how to arrive at a composite rate using productivity efficiency and production elements. With the composite rate, manhour estimating can be applied with equal validity to any electrical job, in any location.

In addition to supplying labor units for installation of inside wiring systems, the manual contains information on outside construction, underground duct and cable installation, and special communication and signal systems, such as hospital address systems, burglar alarm, or centralized radio systems.

The book also contains a complete section on demolition, excavation, and concrete work in connection with electrical work. In addition, a section of technical information on such things as electrical formulas, conduit spacing, and electrical symbols is included.

Corrosion problems

"Cathodic Protection," by L. M. Applegate. Published by McGraw-Hill Book Company, Inc., 327 West 41st St., New York 36, N. Y., 244 pages, 67 illustrations, $9.00.

A complete guide to practical techniques for combatting corrosion of underground and submerged structures by the electrochemical means of cathodic protection, this book explains the chemistry of the corrosion of metals when surrounded by an electrolyte, such as water or moist earth. And it details the principles and practical methods of applying electric currents to mitigate damage under these conditions. Emphasized in particular are the applications of active metals for sacrificial protection, and the use of inert materials connected to external circuits for inert anode protection of iron and steel.

It presents information needed to select and use the necessary instruments, make field surveys and tests, interpret results, design adequate systems, and carry out the construction of cathodic protection installations. Practical examples are shown in the protection of submerged pipelines, cables, aviation fuel tank and line systems, lock and dam gates, ships in storage, and other underground and submerged structures.

The book includes comprehensive material on copper-copper sulfate half-cell characteristics and construction, original material on the relationships of potential reading and probable corrosive conditions, important data on the effect of excessive voltage protection on paints, and an evaluation of such advanced materials as high-silicon cast iron anodes and hit-line enamels.

Industrial electricity

"Electrical Efficiency in Industrial Plants," by Edwin S. Lincoln. Published by F. W. Dodge Corp., 119 W. 40th St., New York 18, N. Y., 235 pages, illustrated, $9.50.

A practical engineering guide to lower power costs, this is one of the first books to attack specifically the problems of reducing electric power and lighting costs in industrial plants and larger commercial buildings.

The book points up the fact that waste and misuse of electric power is a major and frequently hidden drain on efficiency and profit. The only way to cut this waste is by constant analysis and correction of usage. This book outlines practical methods that any engineer or supervisor can use.

Down to earth in every detail, the book tells exactly how to make surveys of load, power factor, voltage, lighting, wiring, and electric protection. All necessary instruments are discussed in detail, with emphasis on their selection, continued use, and maintenance.

Full analysis of power costs is also included, with particular attention to methods of lowering rates by minimizing peak demands.

Hi-Fi and FM repairing

Servicing Hi-Fi and FM in the Customer's Home," by Milton S. Kiver. Published by Howard W. Sams and Co., Inc., Indianapolis 6, Indiana, 160 pages, illustrated, $2.95.

In this book a wide range of quick and easily-performed test methods are described for high fidelity amplifiers, AM-FM receivers, record changers, turntables and tape recorders. All testing methods are selected for their quick application and for their effectiveness in locating actual and potential trouble areas in hi-fi equipment.

Chapters 1 and 3 discuss the modern circuitry of hi-fidelity amplifiers, AM-FM tuners and receivers. Chapters 2 and 4 cover those test methods best designed to reveal sources of the trouble, using a VTVM or a 20,000 ohms-per-volt meter and small detector probe. Chapter five covers the easy-to-apply methods for servicing turn-tables, changers, and tape recorders in the home.

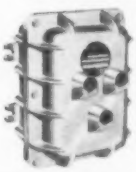
Killark switch rack components

DESIGNED BY FIELD TESTS . . . PLANT SURVEYS . . . CONSULTATION WITH EXPERTS Here is the complete line of all-aluminum enclosures, completely wired and ready to install . . . designed only after extensive research in the field and consultation with dozens of industries, engineers and consultants, to learn what *you* need and want in this line.

These features are the result: *All-aluminum* for non-magnetic, non-corrosive, lightweight design that offers faster heat dissipation. *Ribbed* for greater strength. *Rectangular design* for easier installation and maintenance, more compact assembly. *Ground surfaces* for tighter fit, no threads to strip. Front operation on all components.

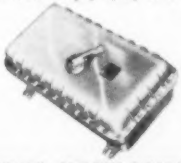
PANEL BOARDS
To your specs, including breaker of your choice. Screw-cover or bolt-on cover, rectangular or "T" wiring trough. Available for hazardous as well as all-weather areas. All seals and connections included.

MOTOR STARTERS



Manual or magnetic, in many forms. Single speed, reversing, two speed, special, and combinations.

CIRCUIT BREAKERS
Through 800 amps, 1, 2, or 3 pole.



DISCONNECT SWITCHES

Fuseable and non-fuseable, up to 200 amps.

CONTROL COMPONENTS—Push button stations, pilot lights, selector switches, contactors, relays, control transformers, lighting transformers, specials.

ILLUSTRATED CATALOG SUPPLEMENT—State your interest.

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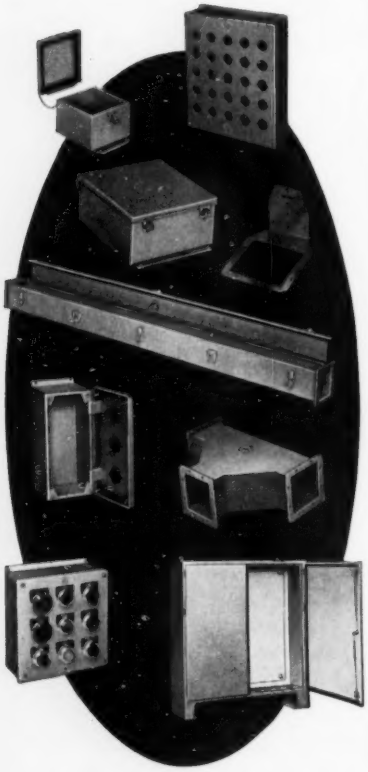
Sold Through Leading Distributors:
WAREHOUSE STOCKS in NINETEEN CITIES in U. S. and CANADA!

For liquid-tight wiring enclosures built to JIC and Nema standards...



It pays to figure on

KEYSTONE

Keystone offers a complete line of JIC and Nema enclosures to give positive, sealed protection against dust, dirt, oil, water and coolants! All types and sizes of liquid-tight wireways, fittings, troughs, boxes and cabinets—*to meet your exact needs.*

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MANUFACTURING CO.
23333 Sherwood Ave. • Warren, Mich.

Helpful literature

available to our readers

A new catalog from **Prescolite Manufacturing Corp.,** 229 Fourth St., Berkeley, Calif., describes diecast aluminum wall bracket and ceiling **lighting fixtures** suitable for both indoor and outdoor installation. The Dielux series fixtures are weatherproof and rust proof and come in a wide selection of contemporary styles. Dimensional drawings and color pictures illustrate the units in the four-page brochure.

Write B-335 on reply card, pg. 20

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill., announces the release of a new "Allied Connector Directory". Containing comprehensive listings of the most widely used **electronic connectors,** this 16-page directory is offered as a convenient buyer's guide for manufacturers, research labs, engineers, designers, etc. Alphabetically arranged by manufacturers, Amphenol, Cannon, Cinch-Jones, Harvey Hubbell, and Hart & Hegeman connectors are listed in numerical order for easy reference. This directory is Issue No. 1 of a series planned by Allied. Subsequent issues will be released as new connectors are made available by manufacturers.

Write B-336 on reply card, pg. 20

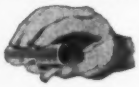
The **Furnas Electric Co.,** 1064 Mckee St., Bativa, Ill., recently published a new colorful seventy-two page **motor control catalog** 5900 that provides a condensed but thorough listing of general products, some of which are new within the last year. Special "quick selector" charts for magnetic and manual starters give horsepower, motor speed, heater size, heater ampere ratings, enclosure choices, along with style numbers and list prices in one easy-to-read table.

Write B-337 on reply card, pg. 20

Overhead-type conventional **distribution transformers** are described in bulletin DT2, published by **Line Material Industries,** McGraw-Edison Co., Milwaukee 1, Wis.

BLACKHAWK INDUSTRIES SNAP STRAP

the original snap-on clamp

SNAPS TIGHTER,  **HOLDS ITS GRIP**

easier to sell because it's easier to use

WHY it's better—The B-I SNAP STRAP has the "hold bump" at the open end of the bracket—really grips—resists slips like an alligator wrench! Ribbed bracket adds to the snap, provides rigid contact support of the conduit!

SPEEDS WORK... MORE JOBS, MORE PROFITS—Faster installations mean more profit for installers and their suppliers. The SNAP STRAP *means* faster installations . . . eliminates time-wasting fumbling, dropping, annoyance—all the *temper* is in the SNAP STRAP. Made of heavy gauge steel, zinc plated after fabrication. Wide range of sizes for rigid and thin-wall conduit.

Contact Your Nearest Representative—

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Keith Wahlstrom, 5540 Mason Cove, Memphis, Tenn.
Griffin & Griffin, 1185 Howell Mill Rd., N.W. Atlanta, Ga.
John Collins, Box 26, Tampa, Fla.

specify B-I when you buy

Blackhawk Industries

BLACKHAWK INDUSTRIES
DUBUQUE, IOWA

This new publication covers standards, application information, design and operating features, accessories, and ordering information. L-M's single-phase transformers have standard ratings of 2.4 through 67 kv, and 5 through 500 kva.

Write B-338 on reply card, pg. 20

Halo Lighting Products, Inc., 3232 W. Chicago Ave., Chicago 51, Ill., announces the completion and release to the industry of its new full color 24-page **lighting** catalog for 1960. In addition to basic square, round and rectangular recessed housings and trims, the colorful catalog features such new units as pendant and surface ellipses, pendant spheres, wall and ceiling brackets, "Fitall" housing for round trims, "AllGlas" trims, and projector spotlite and adjustable downlite.

Write B-339 on reply card, pg. 20

GEC-1260D, new 72-page publication contains information on the complete line of **control devices** manufactured by the **General Electric Company's General Purpose Control Dept.,** Schenectady 5, N. Y., Illustrated catalog includes complete product description of motor starters both manual and magnetic, contractors, relays, solonoids, limit switches, push buttons, static control and pilot devices. Pricing tables for each device are included with descriptive information. Features, wiring diagrams, dimensions and application information for each device are also included.

Write B-340 on reply card, pg. 20

One of the electrical industry's most complete and diversified line of molded case **circuit breakers** is described in a comprehensive new bulletin published by **I-T-E Circuit Breaker Co.,** 1900 Hamilton St., Philadelphia 30, Pa. The illustrated, 40-page, two-color bulletin gives ratings, specifications and operating characteristics as a guide to designers, contractors and consulting engineers in selecting breakers for a wide variety of applications.

Write B-341 on reply card, pg. 20

The completely revised 24-page catalog of **switches and quick connect terminals** made by the **Ark-Lee Switch Corp.,** 51 Water St., Watertown 72, Mass., gives detailed information on the expanded product line. Comprehensive data on multi-circuit push-button switches and the new multi-circuit stack switches have been added to the information on range-heater, motor-reversing, toggle, and slide switches. Catalog gives details of handles, hardware, shaft styles, and terminals and includes dimension drawings, wiring diagrams, circuit sequences, and electrical ratings for each switch listed.

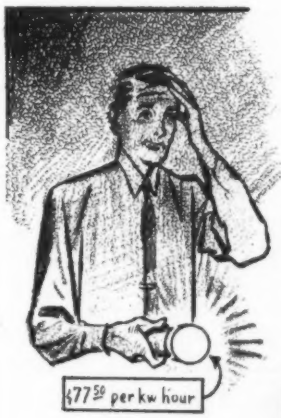
Write B-342 on reply card, pg. 20

Facts of Light!

CHAMPION Lamps

SOMETIMES IT COSTS MORE TO OPERATE ONE FLUORESCENT THAN TO OPERATE TWO

When only one fluorescent lamp is operating on a lead-lag ballast designed to handle two lamps, more line current can be drawn than if both lamps were operating. This is due to a shift in power factor. Moral: keep all lamps operating — you can draw less current and get twice the light.

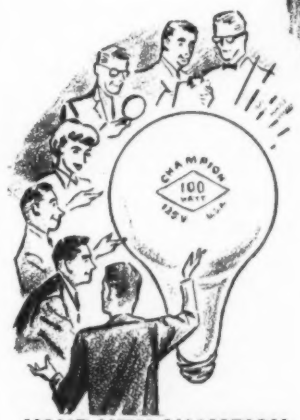


IT COSTS $77.50 per KW hour to RUN A FLASHLIGHT

When a lamp is run on a flashlight battery the power cost is in the vicinity of $77.50 per KW hour. The power cost to operate lamps from residential electric supply is only 2.66 cents per KW hour.

A LITTLE VARIATION IN VOLTAGE CAN MEAN A LOT IN THE LIFE OF A LAMP

Incandescent lamps are designed to yield maximum lighting economy when used on circuits where the voltage is the same as that printed on the bulb. When the circuit voltage is 5 volts above the bulb rating lamp life can be cut in half. A variation of 5 volts below rating can double lamp life.



YOUR NEW CHAMPION LAMP HAS ALREADY BEEN LIGHTED AT LEAST 7 TIMES

Every Champion lamp is lighted a minimum of 7 times before it is packaged. Checks like this are typical of the strict quality control maintained at Champion and one of the reasons why the Champion Diamond on the outside of a lamp means a dependable source of light on the inside.

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT • *YOUR BEST BUY IN LAMPS*

IN ELECTRIC HEAT THERMOSTATS... WHITE-RODGERS IS THE LEADER!

Use them with confidence—they're specifically designed for Electric Heat by White-Rodgers—world's largest maker.

Sold under the brand names of more than fifty manufacturers of quality electric heating equipment.

Type 1A61
World's Largest Seller

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Elegant New Companion

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ELECTRICAL ESTIMATING GUIDE

Covers Over 2000 Wiring Jobs

This new, entirely different estimating guide has 200 completely worked out charts.

Authentic, Time Saving—Easy to Use

This book is easy to use—it has no complicated mathematics or formulas to work over. You merely determine the nature of the wiring, check it in the BLUE BOOK OF ELECTRICAL ESTIMATING and there's your answer—it's the simplest estimating book ever written.

NEW CODE BOOK FREE FOR EXAMINING BOOK

For a limited time the publishers offer a copy of the latest National Electrical Code book for just examining the new Blue Book of Electrical Estimating.
This book was written by a successful electrical contractor and estimating engineer with over 20 years' experience. It has an entirely different method of determining estimates on wiring jobs. Electrical contractors, journeymen, architects, and engineers will find use for this book every day. Gives time required to do jobs along with complete labor charges in every state in the country. Check the PRODUCTIVITY of your men with this authentic, field tested book. Order this book now from your supplier at special introductory price of $8.25 or send coupon below.

ESTIMATING HANDBOOKS ASSOCIATES — 5848 N. LEONARD AVE., CHICAGO 30, ILL.

Send me the NEW BLUE BOOK OF ELECTRICAL ESTIMATING for 5 days free trial. I understand I may return the book within 5 days and owe nothing. If I keep it I will pay $8.25 plus postage for shipping.

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☐ **I enclose $8.25 to save shipping cost.**
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(March 1960)

Design, engineering and safety features of the Holan elbow, manufactured by **Holan Corp.,** 4100 West 150th St., Cleveland 35, Ohio, are graphically illustrated in a new six-page brochure. Technical information and construction details of all three models of the **aerial elbow**—HD-42, HD-50 and HD-55—are included in the folder, along with descriptions and illustrations of special features and optional equipment.

Write B-343 on reply card, pg. 20

Just released by **Bussmann Mfg. Division of** McGraw-Edison Co., Milwaukee 1, Wis., is the new issue of the Protection Handbook. This book contains helpful suggestions for selecting proper **protective devices** for electric circuits, motor appliances and apparatus. It condenses in one spot all Code references covering various protection problems. It shows simplified diagrams of various circuits. It explains how installation costs can be cut and space saved by use of dual-element fuses.

Write B-344 on reply card, pg. 20

A new Contracting and Maintenance Catalog No. 85 has just been issued by **Buchanan Electrical Products Corp.,** Hillside, N. J. Especially prepared for electrical contractors and plant maintenance departments, the 8-page illustrated catalog features Buchanan pres-SURE-connectors for wire splicing and terminating, also sectional and one-piece terminal blocks. In addition it contains information on time-saving squeeze-type cable **connectors,** insulated conduit bushings, knockout plugs and cable staples.

Write B-345 on reply card, pg. 20

A new bulletin describing Transclosures for housing **distribution equipments** at ground level has been released by **Line Materials Industries, McGraw-Edison Co.,** Milwaukee 1, Wis. Transclosures are used for underground distribution systems that (1) serve residential, industrial, or commercial areas; (2) supply highway lighting circuits; or (3) require automatic switching equipments. They enclose standard overhead distribution transformers or other apparatus rated 2.4 kv through 14.4 kv.

Write B-346 on reply card, pg. 20

A new illustrated brochure describing **lights** designed for hospital, hotel and dormitory installation is now available from **Prescolite Manufacturing Corp.,** 2229 Fourth St., Berkeley, Calif. The four page catalog is in color. UL— listed bed lights shown in the brochure provide both indirect and direct illumination in one unit. Both fluorescent tubes and incandescent lamps are included.

Write B-347 on reply card, pg. 20

Bulletin GEA-6794A, 12 pages from **General Electric Co.,** Schenectady 5,

N. Y., describes the features, operation and characteristics of the new Form 3K Thyrite Magnevalve **station arresters** for high and extra-high voltage applications. Publication includes photographs, oscillograms of long-duration, and discharge current withstand tests.

Write B-348 on reply card, pg. 20

A booklet describing a new high-frequency bus duct made by **Westinghouse Electric Corp.**, P. O. Box 2099, Pittsburgh 30, Pa., is now available. Entitled "High Frequency Bus Duct," the publication outlines **bus duct** features and contains a curve of voltage drop at 400 cycles per second plotted against load.

Write B-349 on reply card, pg. 20

A new reference work for architects, engineers, and contractors dealing with electrical design and construction is now offered by **Daleto Co.**, P. O. Box 345, Alhambra, Calif. The publication, "Typical Electrical Construction Specification," is especially geared to aid in preparation of **construction specifications** for all types of projects.

Write B-350 on reply card, pg. 20

Bulletin GEA-6981, 12 pages, describes the features, installation, application of General Electric's **pad-mounted transformers** (complete distribution units rated 24 to 100 kva) and semi-buried transformer enclosures for pole-type distribution transformers up to 167 kva, made by **General Electric Co.**, Schenectady 5, N. Y. The publication also includes photographs, dimensional drawings, rating tables and a circuit diagram for a typical underground residential system.

Write B-351 on reply card, pg. 20

Prescolite Manufacturing Corp., 2229 Fourth St., Berkely, Calif., now has available a new catalog of prewired **recessed lighting fixtures** designed specifically for use in concrete pour construction. The brochure, "Concrete Pour Units Catalog", CP-1, consists of four pages in color, describing and illustrating the new series of factory assembled fixtures. It contains specification charts as well as housing-plan views.

Write B-352 on reply card, pg. 20

A guide to **electric heating elements** made by **Vulcan Electric Co.**, 88 Holten St., Danvers, Mass., is now available in a new brief, condensed folder. Representative selections from each line of heaters are illustrated and described: cartridge heaters, tubular heaters; immersion heaters; strip heaters; band heaters; fuel oil heaters; circulation heaters; air duct and radiant heaters; and soldering equipment are included in this Bulletin VG-100.

Write B-353 on reply card, pg. 20

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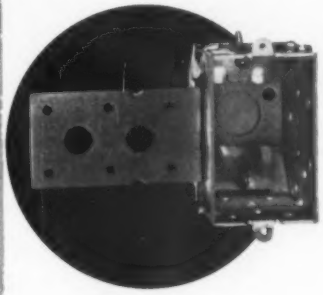
SWITCH AND OUTLET BOXES:

Over 250 stock items from the simplest nail-up switch box, to nine gang boxes. All popular sizes of knockouts and types of clamps. Brackets are **riveted** (not spot welded) to boxes for maximum strength. Combination box and bar sets that save time and money for the contractor. All packaged in sturdy cartons with attractive, descriptive, easily read labels.



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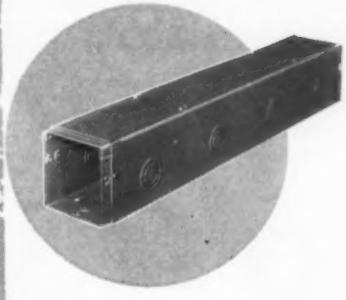

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Bulletin FC3, describing Type LMO open **fuse cutouts,** is now available from **Line Material Industries, McGraw-Edison Co.,** Milwaukee 1, Wis. Type LMO cutouts rated 100 amperes at 7.8, 15, and 27 kv have maximum interrupting capacities of 20000, 16000, and 6000 amperes respectively. Included in FC3 are descriptions, application data, dimensional and ordering information, and outstanding features.

Write B-354 on reply card, pg. 20

"Bronco 66 Certified," a new booklet describing **control cables,** is now available from Richard O. Pallin, assistant sales manager, **Western Insulated Wire Co.,** 2425 East 30th St., Los Angeles 58, Calif. The booklet describes features of the new oil-resistant, protected cables.

Write B-355 on reply card, pg. 20

A 4-page, 3-color brochure introduces and illustrates the twelve comprehensive design features of the new line of pole type **distribution transformers** made by **R. E. Uptegraff Manufacturing Co.,** P. O. Box 182, Scottdale, Pa.

Write B-356 on reply card, pg. 20

A new 32-page booklet, "The Good Guy," has been published by **Preformed Line Products Co.,** Dept. GG-7, 5349 St. Clair Ave., Cleveland 3, Ohio. The new booklet illustrates step-by-step application procedures of Guy-Grip deadends at the top, breaker, and anchor locations of **down guys.** Containing 48 photographs, the booklet illustrates procedures to be used in single guying, and multiple guying.

Write B-357 on reply card, pg. 20

Comprehensive technical information on resistance and reactance of **aluminum conductors** for overhead transmission lines is now available from the **Rome Cable Div., Aluminum Company of America,** 1501 Alcoa Bldg., Pittsburg 19, Pa. Latest research findings, including information hitherto unavailable, are incorporated in "Resistance and Reactance of Aluminum Conductors." The new report comprises Section 5 of Alcoa's long-range technical research publication project for the utility field, titled Alcoa Aluminum Overhead Conductor Engineering Data.

Write B-358 on reply card, pg. 20

Kindorf channel, fittings, hangers, and supports are covered by a new catalog-handbook just published for electricians, electrical contractors and engineers by **Steel City Electric Co.,** 1207 Columbus Ave., Pittsburgh 22, Pa. The new reference type work manual contains product illustrations, and correlated information for correctly specifying and using Steel City's **structural support materials** for electrical installations.

Write B-359 on reply card, pg. 20

Massey DUPLEX RECEPTACLES MEET YOUR NEED!

- √ CSA App. NO. 8141
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- √ Meets REA Spec.
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The No. 5009 has been designed to satisfy the most critical requirements — metal parts in tension and porcelain in compression. All steel parts are HOT-DIP GALVANIZED. The Porcelain has been designed with well-rounded edges and provides a larger, pulley-action wire hole. The spun solid copper rivet interlocks the Insulator with the metal portion of the Wireholder. Extra sharp screw thread for easy starting and full threaded. The heavy screw-shank base offers high resistance to side pull. KNOX No. 5009 Wireholders far surpass recommended ratings on standard house service conductors. This Wireholder can also be supplied with 22 x 3" and 22 x 4" Screws.

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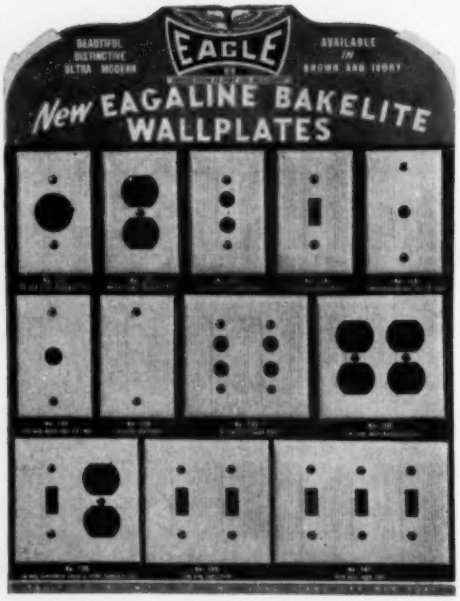

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EAGLE ELECTRIC MFG. CO., INC., LONG ISLAND CITY, N.Y.

Bulletin GEA 6108C, 32 pages, revised, gives latest information on **repetitive manufacture transformers,** 501-5000 kva, single-phase, and 501-10,000 kva, three-phase, made by **General Electric,** 1 River Rd., Schenectady 5, N. Y. Construction details, accessories, features, ratings and characteristics are given. Performance data and dimensions are listed for all type units.

Write B-360 on reply card, pg. 20

Bulletin GED-3613, a 20 page informal discussion of **sample testing meters,** acceptable accuracies, and economic feasibility of meter testing, is now available from **General Electric Company,** 1 River Rd., Schenectady 5, N. Y.

Write B-361 on reply card, pg. 20

Twenty-three JFR distribution **voltage regulator** features designed to provide more economical and better voltage regulation are described and portrayed in a new bulletin released by **Allis Chalmers,** 938 S. 70th St., Milwaukee 1, Wis. The new regulator's smaller size, up to 33 percent in height and weight, assures greater versatility in pole, platform and substation mounting.

Write B-362 on reply card, pg. 20

A new, colorful 20-page brochure is designed and published by **R. E. Uptegraff Manufacturing Co.,** P. O. Box 182, Scottdale, Pa., to assist engineers and architects in planning **power center substations.** It includes drawings, dimensions, weights, performances and other data on basic units of load center transformers along with complete details of standard transformer arrangements planned for use with switchgear and other equipment. A variety of terminal appurtenances is also included.

Write B-363 on reply card, pg. 20

A new twelve-page Ballast Buyers Guide is available from **Sola Electric Co.,** 4633 W. 16th St., Chicago 50, Ill. It is organized to permit quick, easy selection of the proper **ballast** for a wide range of fluorescent lamps. The guide includes all information necessary for a Ballast specifier—electrical and mechanical specifications and wiring diagrams. Ballasts are listed for both indoor and outdoor applications of fluorescent lamps.

Write B-364 on reply card, pg. 20

Precision electrical instruments are described in a new color brochure from **Weston Instruments Div., Daystrom, Inc.,** 614 Frelinghuysen Ave., Newark 12, N. J. Instruments described include d-c voltmeters and ammeters; a-c or a-c and d-c voltmeters, ammeters, and wattmeters; current transformers; and low voltage standardizing potential transformers and high voltage potential transformers.

Write B-365 on reply card, pg. 20

NEED CAST BOXES?

save time and money

Consult HOPE first

for the largest selection of types and sizes in the industry

When you are designing or installing electrical conduit systems, for enduring weather resistance, (NEMA IV), or security from hazardous vapors, (NEMA VII), or from hazardous dusts (NEMA IX), HOPE *has* complete listings of sizes for each type of installation.

Cast weatherproof boxes are needed for lighting and power services on: Dams, highways, tunnels, bridges, industrial plants, docks and the non-hazardous areas of petroleum and chemical process plants.

Cast explosion-resisting boxes are needed in areas having hazardous concentrations of vapors: refineries, chemical plants, sewage disposal, pumping stations, missile sites, paint and solvent manufacturing.

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Apparatus, devices or panels for the operation in any of these areas can be enclosed in standard HOPE boxes • Many modifications are available on our standard boxes • Standard or modified boxes can be factory equipped with the apparatus of your choice.

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HOPE ELECTRICAL PRODUCTS CO.

41 Long Ave., Hillside, N. J., ELizabeth 4-7837

Kerrigan Iron Works Co., Lighting Standard Div., 1033 Herman St., Nashville 2, Tenn. has just published a 20-page guide to planning and promoting **street lighting** programs entitled: "A Bright City is a Safe City." It contains basic information including fundamental factors such as discernment methods, glare, light distribution, luminaire mounting height tables, traffic volume charts, and outlines on how to plan and promote adequate street lighting programs.

Write B-366 on reply card, Pg. 20

Conductor data

(Continued from page 76)

supplying data applicable to a given size conductor, rather than the usual procedure of calculating the losses on a basis of consecutive intervals of diameter which do not correspond to actual conductor diameters.

When any considerable number of calculations are to be performed, as was here the case, it is advisible to set up and reduce to their simplest form all values that are applicable to the basic air temperature and temperature rise under consideration. By following this procedure the work is greatly shortened and simplified and the probability of error in the final result is reduced to a minimum. Solution of a typical example will demonstrate the procedure.

(This series will be continued in the April issue.)

Network test set

(Continued from page 68)

er adjustment or maintenance. In this manner, the testing crew is not unnecessarily delayed.

Field test procedure

Field test procedure is simple and rapid. The network protector is first disconnected from the network and rolled out for easy access. The relay remains in place. A visual inspection is made and the field test set is connected to the protector terminals and power supply by means of battery clamp equipped leads.

With the protector in the open and automatic position, the "no go" value of reclosing voltage is applied by the test set through proper positioning of the potential selector switch (switch #2 on the diagram). The type SB main spring return switch (#1) is then turned to the left or "close" position supplying the selected potential to the protector terminals. As

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this voltage is less than that required for reclosure, the protector should not operate.

Switch #1 is released to return to the center or "off" position. Switch #2 is then advanced two places to 1.3 volts in the case of a 1,600 ampere protector. Again switch #1 is moved to the "close" position. Since a voltage of sufficient magnitude is now impressed across the network protector terminals, the relay "close" contacts should make contact resulting in the closing of the protector.

Connections are then made to test the reverse power opening aspects of the relay. With the protector closed and automatic, switch #1 is turned to the "trip" position. Since only the permanent load R-1, is in the circuit, the "no go" value of reverse current is drawn through the protector. Nothing happens; switch #1 is released. Toggle switch #3 is then closed adding resistance load R-2. In the case of a 1,600 ampere protector, the "go" value of reverse current is reached and the relay, if operating properly, causes the protector to open. As stated before, switch #4 controlling load R-3 is brought into play in a similar manner when running tests on 2,000 and 2,500 ampere network protectors.

Code discussion

(Continued from page 48)

and NMC may both be used for interior wiring and, for this purpose, both have the same restrictions and are interchangable.

Surface extensions

Non-metallic surface extensions as defined in Article 342 are, as the name implies, restricted to extending an existing circuit to additional outlets. The provisions of this article are very clearly stated, and the subject treated is not complicated or involved. Hence, there is little need for explanatory comments.

Such extensions from existing outlets are very frequently made also, of course, by the use of surface metal raceways and by multi-outlet assemblies as well as by non-metalic surface extensions. Multi-outlet assemblies are not only well adapted for this purpose but also offer the added convenience of outlets at frequent intervals if care is taken not to overload the existing circuit.

Article 344 governs similar extensions from existing outlets when such extensions are to be underplaster extensions instead of surface extensions. In underplaster extensions, regular wiring methods are generally used. However, in this very restricted use of outlet extensions, a single a-c conductor is permitted to be installed in a metal raceway or metal armor where space does not permit the use of cables or raceways large enough to accomodate both conductors.

This is so seldom resorted to that only a few inspectors or contractors have ever seen it done. Most modern contractors use modern techniques rather than antique tactics such as this.

Since Type MI cable is now available with single conductors contained in a nonferrous and very small diameter cable armor, there is no longer any need to resort to running single conductors in ferrous armors and raceways. Yet, as long as the practice, as restricted by Article 344, is essentially safe, there is no point in removing this permissive provision from the Code until everybody concerned agrees that it is not needed.

In the next issue, we will begin our discussion with metal raceways.

Answers to Code test questions: (1. **T** Section 336-3-b) (2) **T** Section 336-11) (3. **F** Section 338-3-b) (4. **T** Section 339-3-d) (5. **F** Section 342-4-a) (6. **a** Section 342-3-d) (7. **c** Section 342-8) (8. **b** Section 342-5) (9. **b** Section 344-1) (10. **a** Section 344-4).

Know the law

(Continued from page 32)

was not shown.

Principle passages of the court's opinion:

"Examining boards are generally constituted and established for the purpose of protecting the public against incompetents who seek to enter the various vocations and professions. Such boards are not vested with arbitrary hegemony [power] over the rights of the individual, but are charged with the duty to administer their rules and regulations equally and justly as between all persons and groups who come within the bounds of their jurisdiction. So long as these boards conduct their examinations fairly and uniformly in accordance with lawful authority and their own rules and regulations, their judgment as to the proper grading

of such examinations will not be disturbed by the courts, unless clearly shown to be arbitrary or devoid of logic and reason.

"It is clear from the evidence in the instant case that the respondent Board, in the exercise of its lawful authority, determined that the relator failed to earn a passing grade on its examination. Admittedly there will be questions on examinations of this type for which the amount of credit to be given various answers may differ in the minds of reasonable men. That such condition exists is not alone sufficient cause upon which to bottom an alleged abuse of discretion, particularly when as here the ultimate responsibility for assigning grades to such answers falls on those who have been duly elected or appointed to the board and whose function it is to issue a certificate of competency only after being satisfied as to the applicant's entitlement. Under such a circumstance the court will be extremely reluctant to substitute its judgment for that of the duly authorized board; else the board would be compelled through the judicial arm of mandamus to issue its certificates of competency not in its own discretion, but upon that of the court."

Job control

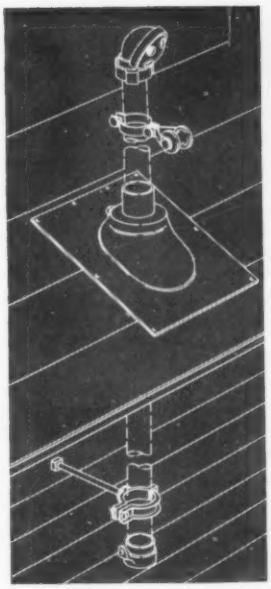
(Continued from page 31)

sample brochure has been approved by the architect and job is released. Every contractor is familiar with time losses when routine has to be changed due to the delay or omission of an item and the men have to work around that omission.

Superintendents raise problems on a job at board meetings, and the problem is recorded. Some strategy or method of solving the problem is worked out. Comments on a job are chalked up. When the problem has been taken care of, it is erased from the blackboard.

If materials do not come in on a job as a superintendent expected, and the superintendent suspects that we are not pushing hard enough, he obtains the proper phone number from the board and does his own additional follow-up. He may phone a supplier or the electrical inspector on his own, identifying himself and running things down for himself.

On a fixture allowance we give builder, owner and architect ample time warning when we shall be ready for the fixtures. In a new



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Now, you can have exactly the right fittings for any mast installation...quickly...at lower cost. Just select the M&W Mast Kit to fit your needs. Varied assortments for 1¼", 1½", 2" or 2½" sizes, split-clamp or pipe strap conduit support, make it easy for you to pick the one kit that best suits your requirements. Best of all, M&W Kits cost less than individual fittings.

Kits include all necessary parts for mast installation as illustrated, except conduit. Fittings available separately.

New Catalog 59 gives details and prices on complete line of electrical fittings. Write for your copy today.

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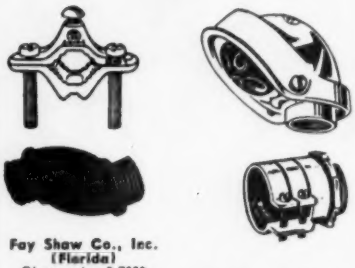

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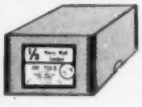

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building where a meter has to be applied for, we see that the customer's signature is available when the meter is ready so that job progress is not impeded. There are many small details that can cause time loss, but persistent attention can reduce these losses. The blackboard provides the best means of job control we have yet put to use.

Case histories

(Continued from page 28)

losses of efficiency of one or two per cent represents a considerable number of dollars over a period of time. Savings of this magnitude would certainly justify the installation of a power factor meter on the starting panel so that the excitation current can be properly adjusted to make the motor operate at unity power factor.

The interesting thing about this particular motor was that the rheostat provided for adjusting the d-c voltage delivered to the motor collector rings had not been moved in such a long time that it required considerable time on the part of an electrical service man to recondition the controls and put the assembly as a whole in working order.

Remote control

(Continued from page 26)

"Regardless of how complex a multi-point low voltage system may look, circuitry is simple, "says Contractor Andrews. Wire is #18 cotton, rubber or thermoplastic insulated, and this is fastened with staples or a stapling machine every 4½ feet.

While some contractors are averse to low-voltage jobs by reason of what they term the "fragility" of the relays and their vulnerability to corrosion and water, "most of the trouble comes because electricians handle the units as though they were locknuts or couplings," says Andrews. "You can't drop a relay and expect it to work; you're better off discarding it at once and using a new one."

Manufacturers' representatives are in agreement with the contractor on this score. Said one spokesman: "We'd much rather the contractor return a damaged unit to his distributor, and we'd be most happy to replace it for free with a new one."

The fact remains that there are some justifiable complaints against some of the sensitive components, but they are minor. What is of major importance is that the unparalleled flexibility, economy, and broader applications of these components to electrical jobs, which makes even the installation of a single switch and one relay practical, is counted by the contractors who are installing low voltage remote control switching as the open door to a more specialized and less competitive avenue of profit.

Washington report

(Continued from page 10)

ly through representatives of their own choosing without previously or at the same time disclosing such payment to all such other employees?"

"During the past fiscal year did you make any expenditure where an object thereof, directly or in-

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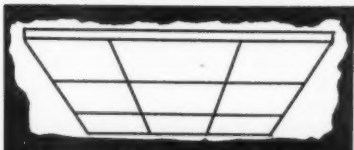
directly, was to obtain information concerning the activities of employees or of a labor organization in connection with a labor dispute in which you were involved?"

"During the past fiscal year did you make any agreement or arrangement with a labor relations consultant or other independent contractor or organization pursuant to which such person undertook activities where an object thereof, directly or indirectly, was to persuade employees to exercise or not to exercise, or as to the manner of exercising, the right to organize and bargain collectively through representatives of their own choosing; or did you make any payment (including reimbursed expenses) pursuant to such agreement or arrangements?"

"During the past fiscal year did you make any agreement or arrangement with a labor relations consultant or other independent contractor or organizer pursuant to which such person undertook activities where an object thereof, directly or indirectly, was to furnish you with information concerning activities of employees or of a labor organization in connection with a labor dispute in which you were involved; or did you make any payment pursuant to such an agreement or arrangement?"

Employers *don't* have to file these forms unless they can answer, "Yes," to one of these questions. For copies of the form write: Bureau of Labor Management Reports, United States Department of Labor, Washington 25, D.C.



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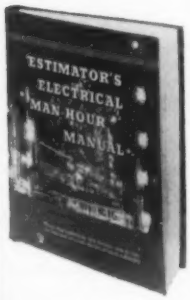

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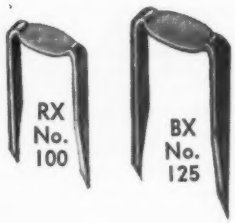

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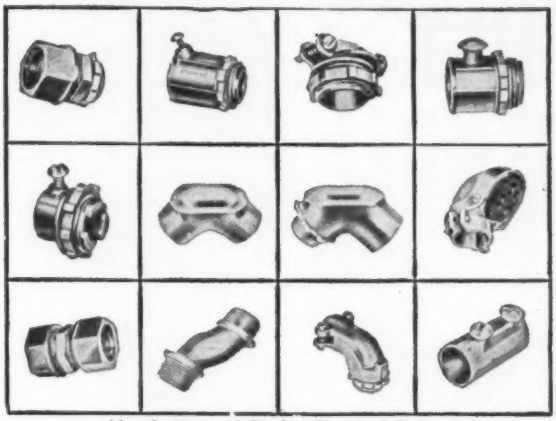

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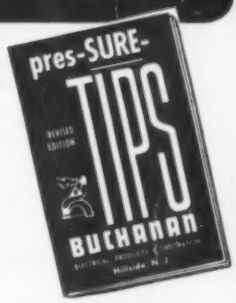

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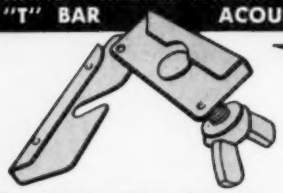

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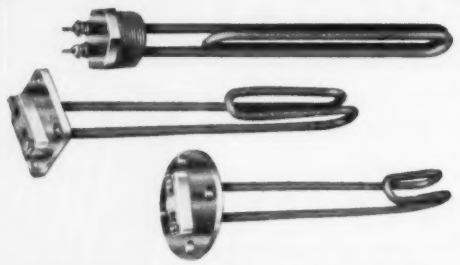

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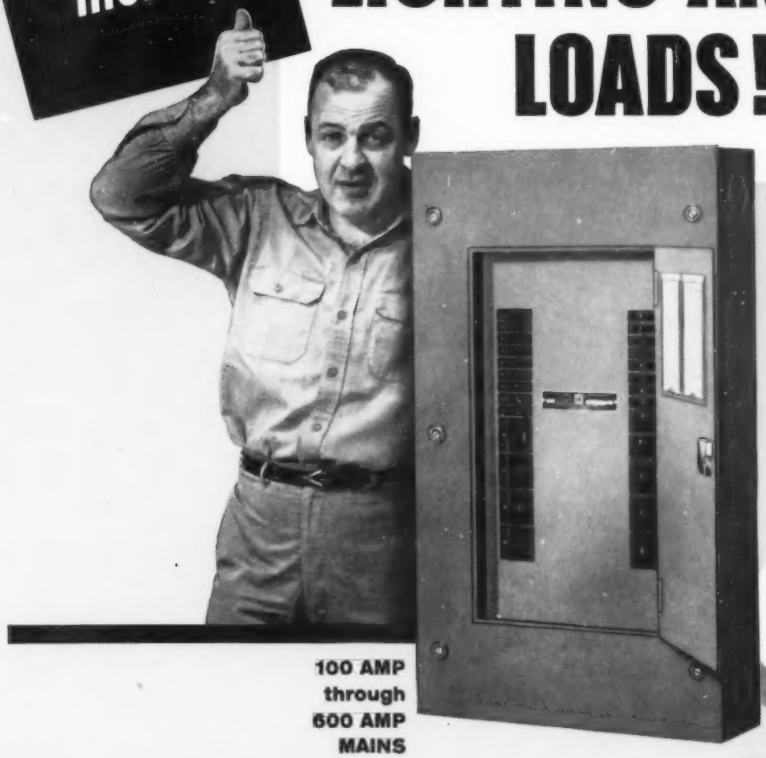

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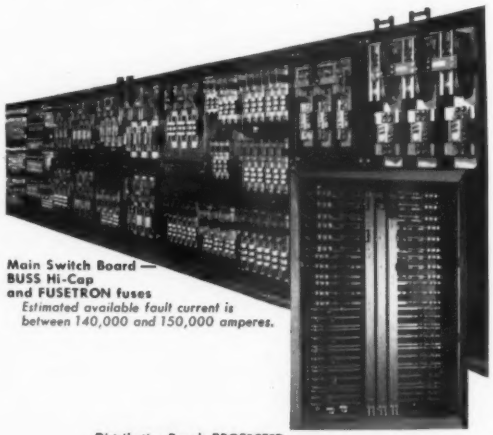

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